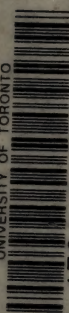


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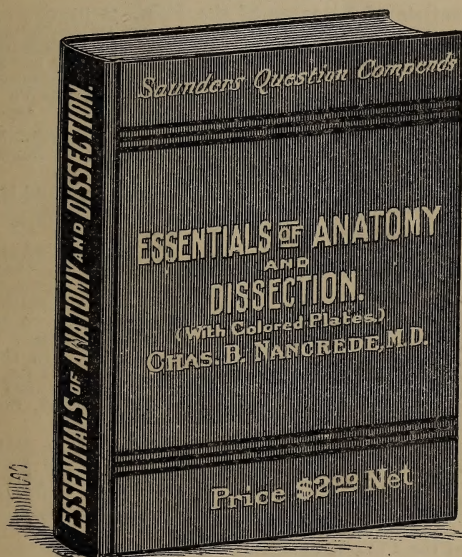
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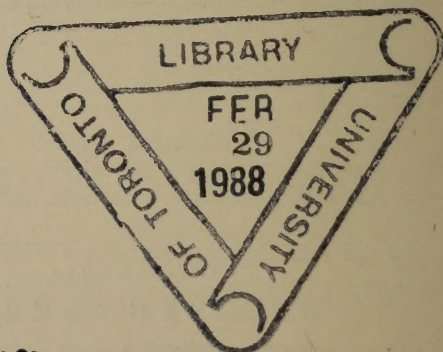
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PREFACE.

This little volume has been written at the request of a few friends who claim some knowledge of my method of presenting pharmaceutical topics, in a tangible form, to the students as Quiz-master. Facing a class with a set of questions made to suit the hour, is a very different thing from writing a compend embracing a series of questions in proper sequence and logical order, such as will comprehend the subject in hand. If this little work fails to accomplish this object, the author feels inclined to say to his disappointed friends that herein lies the cause.

The motto of the student is, in these days of intense activity, get all you can in the shortest time. The author suggests here the proverb:

“Get what you can, and what you get, hold,
'Tis the stone which will turn your lead into gold.”

One of the objects of this book is to assist the student in holding the instruction he receives in the study of pharmacy. On the other hand, it is to open up and map out the subject to the young student in a way that is comprehensible and easily followed. In doing this the Pharmacopœia has been strictly adhered to, and only when felt driven to do so, has the author turned aside from this standard. He believes in making the Pharmacopœia the central figure in pharmaceutical study. If the student familiarizes himself with that book, he becomes capable of branching into directions of scientific study for which he finds ample help in text-books.

The author has followed a classification which differs in a

measure from the leading text-book—"Remington's Practice"—not because he thinks it better, but more particularly to give the student variety. It will be observed that a classification somewhat consistent with the chemistry of the carbon compounds is made in the organic part of the work. The student cannot too early become familiar with such classifications.

The author is indebted to various writers, whose works have been consulted, notably, Remington, Parrish, Potter, Attfield, Watt and others. An article by Joseph W. England, in the *Journal of Pharmacy* for January, 1890, has materially aided him in the part relating to incompatibility. He desires especially to thank Prof. Oscar Oldberg, who so kindly put at the writer's disposal any part of his valuable writings.

L. E. S.

University of Kansas.

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ESSENTIALS OF PHARMACY.

INTRODUCTORY.

PHYSICS.

Metrology.

WEIGHT is the attraction of the earth upon a body.

VOLUME is the space occupied by a certain amount of matter.

SPECIFIC WEIGHT is the relation of the weight of a body to its bulk—the relative weight of equal bulks of different bodies.

SPECIFIC VOLUME is the relation of the volume of a body to its weight—the relative volume of equal weights of different bodies.

STANDARDS OF WEIGHTS AND MEASURES.—These are dependent upon linear measure; best illustrated by the decimal system of weights and measures. In that system the *meter* is the standard unit of linear measure. This meter is the ten-millionth part of the distance from the equator to the poles, which is the basis of the whole system. The cube upon the one-tenth of the meter (decimeter) is the standard unit of fluid measure, the *liter*; the *gram*, which is the standard unit

of weight, is the weight of *one cubic centimeter* (the cube upon the one hundredth part of the meter) of pure water. (See below.)

The English and American *inch* (based upon the length of a pendulum vibrating seconds, in vacuum) is the basis of the Avoirdupois and Troy weight; the weight of one cubic inch of pure water (at 62° F. under the pressure of one atmosphere) is declared to be 252.458 grains. The *Avoirdupois pound* is equal to 7000 of such grains; and the *Troy pound* is equal to 5760 grains.

Systems of Weights and Measures employed in Pharmacy.

TROY OR APOTHECARIES' WEIGHT is used largely in dispensing, while the wine or Apothecaries' measure is employed for liquids (except in compounding, when the Pharmacopœia directs, in most cases, liquids to be weighed).* The table of this system is as follows:

20 grains (grs.),	=	1 scruple (ʒj).
3 scruples,	=	1 drachm (ʒj).
8 drachms,	=	1 ounce (ʒj), or 480 grains.
12 ounces,	=	1 pound, or 5760 grains.

AVOIRDUPOIS WEIGHT.

27 $\frac{11}{32}$ grains,	=	1 drachm (1 dr.).
16 drachms,	=	1 ounce (1 oz.).
16 ounces,	=	1 pound, or 7000 grs. (1 lb.).

* The Committee of Revision of the Pharmacopœia for 1890-1900 has been instructed as follows: "To direct solids to be weighed and liquids to be measured, except in such cases as they find it advisable to use weights only, and that the metric system be employed for this purpose."

WINE OR APOTHECARIES' MEASURE ("American").

60 minims (℥),	=	1 fluid drachm (fʒj).
8 fluid drachms,	=	1 fluid ounce (fʒj).
16 fluid ounces,	=	1 pint (Oj).
8 pints,	=	1 gallon (Cong. j).

THE MEASURE RECOGNIZED BY THE BRITISH PHARMACOPEIA is known as *Imperial measure*; the table is as follows:

60 minims,	=	1 fluid drachm.
8 fluid drachms,	=	1 fluid ounce.
20 fluid ounces,	=	1 pint.
8 pints,	=	1 gallon (10 lbs. Avoir.).

The MINIM is a variable expression of fluid measure. The *minim of American fluid measure* of water at its greatest density weighs about 0.95 grain, being the 480th part of the American fluid ounce of 455.7 grains of water. The *British minim* being the 480th part of the British fluid ounce of 437½ grains of water, weighs about 0.91 grain.

The *American fluid ounce* of water weighs 455.7 grains, and is $\frac{1}{16}$ of the American pint of 7291.1 grains of water.

The *British fluid ounce* of water weighs 437½ grains, and therefore corresponds with their weight standard (avoirdupois) ounce. It is $\frac{1}{20}$ of the British Imperial pint.

The *American fluid drachm* of water weighs 56.96 grains, being $\frac{1}{8}$ of the American fluid ounce of 455.7 grains of water.

The *British fluid drachm* of water weighs 54.68 grains, being $\frac{1}{8}$ of the British fluid ounce of 437½ grains of water.

The Metric System.

The units in the metric system are as follows:—

THE METER (unit of length	=	39.37 inches).
“ GRAM (“ “ weight	=	15.432 grains)
“ LITER (“ “ fluid measure	=	33.814 U. S. fluid ounces).

The names of the subdivisions of these units are expressed by prefixing the Latin numerals, milli, centi, and deci, and

the names of the multiples by prefixing the Greek numerals, deka, hecto, and kilo, to the unit. These prefixes, arranged in numerical relation, furnish a table as follows:—

DECIMAL SYSTEM.	WRITTEN.
10 Milli- (.001) = 1 Centi-	.01
10 Centi- = 1 Deci-	.1
10 Deci- = 1 Unit	1.
10 Units = 1 Dekka	10.
10 Dekka- = 1 Hecto-	100.
10 Hecto- = 1 Kilo-	1000.

If the student will supply or insert a unit (Gram, Liter or Meter) after each one of the above prefixes (milli, centi, etc.) he will have practically a complete table of the metric system.

The cubic centimeter and the gram.

Fluid measure in the metric system is usually stated, in dispensing, in *cubic centimeters* (abbreviated c.c). The intimate connection between the cubic centimeter and gram is interesting: this connection will be seen at once, as one c.c. of distilled water (at 4° C.) weighs one gram. Hence the cubic centimeter is sometimes called a “fluid gram” (fluid-gram).

Approximate equivalents in other systems.

The following are given as some of the principal equivalents for the student to commit to memory:—

I. LINEAR MEASURE.

1 Meter (1.) = 39.37 inches (3 ft. 3 inches and $\frac{3}{8}$ inch).

1 Centimeter (.01) = two-fifths inch.

5 Centimeters (.05) = two inches.

25 Millimeters (.025) = one inch.

II. LIQUID MEASURE.

1 Liter = 33.8 fl. oz. (2 pts., 1 fl. oz., 6 fl. dr., 30 m.).

1 c.c. = 16.23 minims (15.43 grains).

III. WEIGHT.

1 Gram	(1.)	= 15.43 grains.
1 Milligram	(.001)	= $\frac{1}{64}$ grain.
8 “	(.008)	= $\frac{1}{8}$ grain.
64 “	(.064)	= 1 grain.
1 Kilogram (1000.	)	= about two lbs. avoirdupois (2.205 lbs.) (about 2 lbs. 8 oz. Troy)

IV. APOTHECARIES' INTO METRIC.

1 fl. oz.	= 29.57 c.c.
1 fl. dr.	= 3.7 c.c.
1 Troy oz.	= 31.103 grams.
1 Av. oz.	= 28.350 grams.

(Remember that the $\frac{1}{8}$ grain and 8 milligrams are about equal ; from this data milligrams may be converted into grains and vice versa.)

Computation of equivalents.—(*Approximate, see Oldberg, Weights and Measures.*)

To convert c.c. into minims or grams into grains.—Multiply by 16.

To convert c.c. into fluid drachms or grams into drachms.—Divide by 4.

To convert grams into Troy ounces or c.c. into fluid ounces.—Divide by 32.

To convert multiples or subdivisions of any metric unit, first convert the multiple or subdivision into the unit or the fractions of the unit and use the above rules, e. g. :—

CONVERT 482 MG. INTO GRAINS.—First convert 482 mg. into gms., which is done by simply pointing off three places ; 482 mg. then = .482 gm. Applying the above rule, we have .482 gm. $\times 16 = 7.712$ grs. ; again—

CONVERT 8 MG. INTO GRAINS.—8 mg. = .008 gm. ; multiplying by 16 we have .128 gr. or $\frac{1}{8}$ gr.

To convert minims into c.c. or grains into grams.—Divide by 16.

To convert fl. dr. into c.c. or drachms into grains.

Multiply by 4.

To convert Troy oz. into grams, or fl. oz. into c.c.

Multiply by 32.

Approximate equivalents of domestic measures.

A tablespoonful,	=	3 v or 20 c.c. (usually stated f 3 ss).
A dessertspoonful,	=	3 ijss or 10 c.c. (usually stated f 3 ij).
A teaspoonful,	=	m lxxx or 5 c.c. (usually stated f 3 j).

The drop varies in size according to the liquid and mode of dropping. An ordinary eye pipette delivers drops of water about one-half minim (.03 c.c.).

Scales and Balances.

SCALES is a term applied to the more common weighing instruments in general.

BALANCES are delicate weighing instruments which indicate at least 1 mg. ($\frac{1}{64}$ gr.), having *knife edges* (usually of nickel or agate) on which the *beams* and *hangers* are equipoised. They are also provided with *rests* to keep them in a state of repose, and *riders* placed on notches on the beam, by which minute differences of weight are determined. Such a balance should be kept in a glass case, to prevent the influences of draughts of air, weather, heat, dust, etc. They should be perfectly true by the spirit level, and on a solid foundation. Delicate balances are usually supplied with cases having set screws on the bottom for leveling. The pans are generally of metal and movable; these should be reversed daily.

Watch crystals are useful for weighing certain corrosive chemicals. Glass or horn pans also are used. *In a properly constructed balance* the arms are of equal length, weight and form, and the pans with their appendages must be equal. The relative positions of the center of gravity and the fulcrum influence materially the character of the instrument. If the center of gravity be too far below the fulcrum, the vibrations will be rapid and of short duration, and a considerable weight will be required to turn the lever. By elevat-

ing the center of gravity, the vibrations will become slower. *In balances intended for heavy loads* the center of gravity is therefore lower than in delicate instruments. Every balance requires to be examined from time to time, no matter how frequently or rarely used.

Specific gravity.

The Pharmacopœia refers to sp. gr. in the following words: "The specific gravity of liquids should be ascertained, if accuracy is required, by means of a specific gravity bottle of suitable capacity at a definite temperature. The specific gravity of alcohol, or of any mixture of alcohol and water may, however, also be ascertained by means of an accurate hydrometer, preferably that prescribed by the U. S. Government for the use of the internal revenue and custom house officers. Whenever specific gravity is mentioned in the Pharmacopœia without reference to temperature, it is to be understood to refer to a temperature of 15° C. (59° F.)."

Pycnometers or specific gravity bottles.

A specific gravity bottle is a bottle having a glass stopper with a capillary opening through it, and of a size to contain accurately 1000 grains (sometimes 500 or 100 grs.) of distilled water at standard temperature: Such a bottle is accompanied with a weight which exactly counterpoises it. In using, the bottle is carefully filled with the liquid to be examined, then dried externally, and then placed on the scales and weighed. The increased or decreased amount of the weight of the liquid divided by 1000 will give its specific gravity.

Care of specific gravity bottles.

The bottle should be wiped dry to remove adhering moisture or dust; and handled as little as possible while containing the liquid under operation, to prevent change of temperature. Specific gravity bottles of fair accuracy may be made by the student himself. Select a small, well-stoppered bottle, clean,

weigh, and make a note of the exact counterpoise, for future reference; then the quantity by weight of pure water at the standard temperature that this bottle is capable of holding, is ascertained, and also noted. The latter weight will be the divisor; the dividend will be the weight of any liquid of which the specific gravity is wanted.

Hydrostatic Balance.

The hydrostatic balance is an accurate balance so arranged that one of the pans is suspended with a shorter stirrup and to the bottom of the pan is attached a hook from which a substance may be suspended by means of a horse hair or piece of thread. The substance is first weighed in the usual manner, the weight is carefully noted as the weight of the substance in air. Then the substance is weighed suspended in water and the weight again noted. The latter weight will show a decrease of the weight in the air; by dividing the weight of the substance by the loss of the weight in water we have the specific gravity of the substance.

Method of taking *specific gravity of solids*.*

Thermometry.

Method of constructing and graduating a thermometer.

A glass tube of uniform bore, having a bulb at one end, is heated over a flame to form a partial vacuum; while heated it is inverted in mercury; on cooling the mercury rises in the bulb, owing to the contraction of the volume of air. The tube is then heated until the mercury overflows, when the tube is quickly sealed by a blowpipe. In graduating, the thermometer is inserted in pounded ice and the lowest point to which the mercury column falls will be the freezing point.

* See Remington's "Practice," Oldberg's "Weights and Measures," or any elementary work on physics.

The thermometer is then put in boiling water and the point to which the mercury rises will be the boiling point. For intermediate temperatures intermediate marks are made.

There are three different thermometric scales in use, namely:
Fahrenheit, Centigrade and Reaumur.

COMPARISON OF THE DIFFERENT SCALES.

	F.	C.	R.
Boiling point	212°	100°	80°
Freezing	32°	0°	0°
Difference.	180°	100°	80°

In order to change the expression of a temperature from one scale to another the following formulæ are useful :

$$* C = \frac{F - 32}{1.8} \quad F = 1.8 C + 32 \quad R = (F - 32) \frac{4}{9}$$

$$C = \frac{5}{9} R. \quad F = \frac{9}{4} R + 32 \quad R = \frac{4}{9} C.$$

* C = Centigrade. F = Fahrenheit. R = Reaumur.

Therefore it is evident that, for example, to reduce Fahrenheit to Centigrade it is first necessary to subtract 32 and then divide by 1.8. The remaining formulæ to be worked as indicated.

Microscopy.

A *simple microscope* consists of but one double convex lens to be held near to the object, or of two or more lenses that can be used singly or all at the same time. When thus used in combination, the two or three simple lenses are not only placed close to each other, but close to the object, the combination acting as though it were a simple lens of much greater magnifying power. In the compound microscope the lenses near the eye magnify the *image* produced by the lower glasses. By separating the lenses of a simple microscope so that the upper shall magnify the image produced by the lower, one has a simple form of a *compound microscope*.

THE ESSENTIAL PARTS OF A COMPOUND MICROSCOPE.

The eyepiece = The lens next the eye.

The objective = The lens next the object.

Magnification.

To compute the magnification given by a microscope it is necessary to multiply together the separate magnification due to the eyepiece and objective. Practically manufacturers use the following formula (not entirely accurate for calculating the magnification*): Divide 100 by the product of what are called the focal length of objective and eyepiece expressed in inches. For example: Two-inch eyepiece and $\frac{1}{2}$ objective. To find the magnifying power: Applying the above rule, $2 \times \frac{1}{2} = \frac{2}{2}$; $100 \div \frac{2}{2} = 250$ diam., the magnifying power. The manufacturers send with their instruments cards referring to the magnifications of the lenses, of which the following is an abstract:—

TUBE OF STANDARD LENGTH (10 INCHES.)

OBJECTIVE.	1 INCH.	$\frac{1}{2}$ INCH.	$\frac{1}{3}$ INCH.	$\frac{1}{4}$ INCH.
Eyepiece . . .				
2 inch (A. . .	46	92	275	800
1 inch (C). . .	80	165	485	1500
$\frac{1}{2}$ inch (E). . .	160	330	970	3000

It will be seen from the above that the eyepieces are sometimes lettered instead of numbered.

The Microscope and the Pharmacopœia.—Generally in descriptions of crude drugs it is sufficient to indicate the distinctive

* See paper by W. LeConte Stephens, *American Journal of Science*, vol. XL, July, 1890.

characteristics that are visible to the naked eye, "and, when necessary, such as are visible under an ordinary good pocket lens magnifying about ten diameters." Ex.—Unguentum Hydrargyri, Amylum, Aloe, Lycopodium, etc. For expert work the compound microscope is invariably called into requisition. *The microscopical unit of measurement is the 1000th of a mm., known as the micromillimeter (mkm).*

Alligation in Pharmacy.

(Higher arithmetic treats this subject comprehensively. See also Remington's "Practice of Pharmacy.")

1 *Problem*.—Given 2 lbs. of a certain powder at 7 per cent., 3 lbs. of another powder at 8 per cent., 5 lbs. of another at 16 per cent. and 6 lbs. of another at 18 per cent.; to find the average per cent.

SOLUTION.

$$\begin{array}{rcl}
 .07 \times 2 & = & 14 \\
 .08 \times 3 & = & 24 \\
 .16 \times 5 & = & 80 \\
 .18 \times 6 & = & 1.08 \\
 \hline
 16 &) & 226 \\
 \hline
 & & 14\frac{1}{8} \text{ per cent.}
 \end{array}$$

Rule.—Multiply the percentage of each kind by the number of it. Add the products. Divide the sum of the products by the sum of the numbers.

2 *Problem*.—Given 4 lbs. of powder at 7 per cent., to be mixed with three other kinds at 8 per cent, 16 per cent and 18 per cent., so that the mixture shall average 14 per cent. To find the amounts of the 8, 16 and 18 per cents. that must be used.

SOLUTION.

By the Linking Method

Average 14	{	7	.	.	.	.	.	.	2
		8	.	.	.	.	.	.	4
		16	.	.	.	.	.	.	7
		18	.	.	.	.	.	.	6
									19

The rates then are for the 1st— $\frac{2}{19}$,	The first, $\frac{2}{19}$ consists of 4 lbs.
2d— $\frac{4}{19}$,	The second, $\frac{4}{19}$ “ 8 lbs.
3d— $\frac{7}{19}$,	The third, $\frac{7}{19}$ “ 14 lbs.
4th— $\frac{6}{19}$.	The fourth, $\frac{6}{19}$ “ 12 lbs.

Explanation.—The 7 per cent. and 16 per cent. kinds when used in certain quantities will give an average of 14 per cent. That is 7 per cent. put into a 14 per cent. average gains 7 per cent. The 16 per cent. put into a 14 per cent. average loses 2 per cent. In a similar manner the 8 per cent. gains 6 per cent. and the 18 per cent. loses 4 per cent.

Therefore, for the average of the 7 and 16 the difference between 14 and 16 gives the proportional part of the 7 per cent. kind, and the difference between 7 and 14 gives the proportional part of the 16 per cent. kind. In the same manner for the 8 and 18. The sum of the parts is equal to 19.

Then, by proportion, find the amounts of the other kinds.
Thus:—

$$\begin{aligned}\frac{2}{19} : \frac{4}{19} &:: 4 \text{ lbs.} : \text{No. lbs of the second} = 8 \text{ lbs.} \\ \frac{2}{19} : \frac{7}{19} &:: 4 \text{ lbs.} : \text{No. lbs of the third} = 14 \text{ lbs.} \\ \frac{2}{19} : \frac{6}{19} &:: 4 \text{ lbs.} : \text{No. lbs. of the fourth} = 12 \text{ lbs.}\end{aligned}$$

Rule.—Find the proportional parts according to the above explanation. Then, by proportion, find the amount of each kind.

3. If the problem be to find the ratio of the ingredients to be used, in order to make a certain definite amount, then the method of solution as given in No. 2 is to be used.

Suppose the mixture to contain 19 lbs., as in No. 2, then $\frac{2}{19}$, $\frac{4}{19}$, $\frac{7}{19}$, $\frac{6}{19}$, of 19 lbs. will be the results required.

Pharmaceutical Processes and Manipulations.

How may the processes used in pharmacy be subdivided?

PHYSICAL PROCESSES.—Desiccation (Exsiccation); Commi-
nution; sifting, etc.

Processes of Extraction (mainly of fibrous and organic ma-
terial).—Maceration; Expression; Infusion; Digestion; De-
coction; *Percolation*.

Vaporization.—Evaporation; Distillation; (Sublimation).

Straining and other Processes of Separation.—Colation; Fil-
tration; Clarification; (Decantation); Decolorization; De-
odorization.

CHEMICAL PROCESSES (mainly of inorganic and crystalline
material).—Solution; Diffusion; Dialysis; Precipitation;
Elutriation; Levigation; Porphyrization; Crystallization;
Decantation; Granulation.

Processes Requiring High Heat.—Sublimation; Ignition;
Calcination; Deflagration; Reduction; Oxidation.

What effect has drying upon vegetable drugs?

Vegetables in drying lose water and volatile oils. Some
of their constituents may undergo oxidation, such as resins,
oils, glucosides, alkaloids, etc.

**If not carefully dried, what changes are vegetables likely to
undergo?**

Crude vegetable drugs, if kept moist, are liable to be affected
by fermentation, mouldiness, and slow decay.

What is meant by the term desiccation?

It is a process of expelling moisture from solid substances.
In the case of vegetable drugs it is accomplished at a temper-
ature not likely to change important constituents (usually
about 120° F.; opium is directed to be dried for powdering
at a temperature not exceeding 185° F.). Between 70° to
90° F. fermentation and mouldiness is most rapid.

How are fleshy or succulent drugs best prepared to facilitate desiccation?

They should be cut with a sharp knife, in thin slices, transversely to the direction of cellular and fibrous tissues, thereby opening the cells and ducts and exposing the greatest surface to evaporation. Ex.—Squill, Colchicum, Calumbo, etc.

What effect has desiccation upon crystalline substances?

Crystalline substances are merely deprived of water of crystallization. (See Exsiccation, *Index*.) Usually a high temperature is used, and the process is known as exsiccation.

What loss in weight is sustained in the desiccation of medicinal substances?

Drugs lose in drying from 1 to 20 per cent. (Opium loses from 9 to 20 per cent. in drying and powdering). Vegetables contain from 30 to 80 per cent. moisture (Stramonium leaves have about 98 per cent. of moisture). Crystalline substances in the processes of exsiccation lose nearly all the water of crystallization. (Sulphate of iron loses 39 per cent. The officinal sodii carbonas exsiccatus is made by driving off 50 per cent. of moisture from the crystallized sodii carbonas.)

Comminution.

What are the varieties of comminution?

Comminution includes cutting, bruising, rasping or grating, grinding, trituration, etc.

What circumstances determine the degree of comminution to which a substance should be subjected preparatory to future extraction?

Soft, spongy material expands in the solvent and becomes permeable in coarse powder, while woody structures resist solvent action comparatively, and require for the removal of active matter a fine powder. Comminution should be most perfect when an insoluble drug is to be administered in suspension.

What classes of substances are most necessarily ground in steel mills and what belong exclusively to stone mills?

Steel mills are advantageous for tough and fibrous material; stone mills for friable substances and for salts and mineral substances.

For what operations and what substances are metallic, wedge-wood and stone mortars used?

For contusing, bruising and triturating in comparatively small quantities. For trituration, shallow mortars of wedge-wood ware or porcelain are best adapted. Crystalline salts should never be triturated in a metallic mortar. Fibrous substances should always be comminuted in metallic mortars.

What materials are reduced by rasping or grating?

Hard and woody substances, as guaiac, are made into fine chips with a saw and rasp. Rhubarb is divided into fine pieces by the use of a fine saw. Nutmeg is reduced with the least loss of fragrant oil by grating.

How are the coarser pulverized substances separated from the finer?

By means of sieves (composed of fine wire, horse-hair, muslin or bolting-cloth), by means of suspension in water (elutriation), and by settling from the air.

What grades of fineness have powders of the U. S. Pharmacopœia, and how are these grades expressed?

The fineness of powders is expressed in the Pharmacopœia by descriptive words, and by terms expressing the number of meshes to the linear inch in the sieve through which they should pass. These different forms of expression correspond to each other as follows:—

Coarse powder,	=	No. 20 powder.	
Moderately coarse,	=	No. 40	“
Moderately fine,	=	No. 50	“
Fine,	=	No. 60	“
Very fine,	=	No. 80	“ or more.

What is a granular powder?

A powder made uniform by rejecting all the particles which pass through a No. 30 sieve and all that fall through a No. 20.

How is the process of Elutriation conducted?

The article to be powdered is ground in a mortar with a large quantity of water, and this is poured off into a precipitating jar and allowed to stand until the coarse particles subside; the liquid is decanted (poured off) and allowed to stand until the finely suspended (very fine) powder subsides. The decantation and collection of powder are continued until the finest powder is reached and the liquid is clear.

What is trochiscation?

The paste (magma) resulting from elutriation is sometimes made into cones; this operation is called trochiscation. Prepared chalk is thus made.

What do we learn from this process of elutriation?

First, that the power of water to hold particles in suspension is inversely proportional to the size of the particles; second, that all materials deposited in water are assorted according to size.

How are impalpable powders made?

Impalpable powders are secured in the process of grinding by mill stones; the finest particles are carried to a certain height by a motion given to the air, and deposit themselves on shelves within the inclosure.

Extraction,—

MACERATION, EXPRESSION, PERCOLATION, DIGESTION, INFUSION AND DECOCTION.

What is maceration; why and how is it employed in pharmacy?

Maceration is the soaking of a substance at ordinary temperature in a liquid (menstruum). It is employed in pharmacy to extract the soluble and active principles contained in drugs; it is also employed to prepare vegetable substances for percolation, in which case a comparatively small quantity of liquid is used to thoroughly soften and expand the cells of the comminuted drug. The process is conducted by placing the comminuted drug in wide-mouthed bottles or jars, adding the required menstruum, setting aside and agitating occasionally, from 2 to 16 days, when the liquid is poured off and the residue expressed.

What materials are most suitably extracted by maceration?

Non-fibrous substances which yield viscid solutions; for example, Aloes (see Tr. Aloes and Tr. Aloes et Myrrhæ). These should be coarsely comminuted for maceration.

Why is not maceration used more generally in making tinctures?

Because it leaves a small quantity of finished tincture in the residue.

How may this objection in many cases be overcome?

By observing the directions of the U. S. P., which states that, when dregs of a tincture or similar preparation have macerated with all or with the greater portion of the menstruum, the liquid portion should be drained off as completely as possible, the solid portion packed in a percolator, and the liquid poured on, until all has passed from the surface, when immediately a sufficient quantity of the original menstruum should

be poured on to displace the absorbed liquid, until the prescribed quantity has been obtained.

How is the term menstruum used in pharmacy?

It is used to denote the liquid capable of dissolving out the soluble principles of vegetable organic drugs. (A liquid capable of completely dissolving inorganic and crystalline substances is termed a solvent.)

What is expression and how employed in pharmacy?

It is the forcible expression or squeezing out of a juice or liquid from moist substances. It is largely employed in pharmacy to separate liquids from marc or drugs (the residue left after straining). The different kinds of presses used are, hydraulic, screw, filter, roller, spiral twist and lever.

What is digestion?

Digestion is maceration above the normal temperature, yet below the boiling point of the liquid.

What is infusion?

Infusion is accomplished by macerating a coarsely comminuted substance with either cold or hot water for about two hours, in a suitable vessel tightly covered. The strained (not expressed) liquid is made up to a certain bulk in the general officinal process by passing water through the strainer; this constitutes an infusion. Two officinal infusions, however, are made by percolation.

What is decoction?

Decoction is allied to digestion; the drug, however, is boiled for a time, the liquid cooled, strained, and in the general officinal process made up to a certain bulk, as in the case of infusion.

What is percolation?

Percolation is a process of extraction in which a menstruum is passed through a porous and properly comminuted solid.

It is employed almost exclusively for exhausting vegetable substances. (Percolation of inorganic material is known as *lixivation*.)

Explain the process theoretically.

The solid body being comminuted according to its nature, and packed in a suitable vessel (percolator), the liquid is poured upon it, and, as it gradually descends, each particle comes in contact with a succession of different particles of the solid and becomes more and more strongly impregnated with the soluble matter, till it escapes from the bottom. The solid particles are brought in contact with a continued succession of fresh portions of the solvent, and part with some of their soluble matter to each till exhaustion is completed, or till the supply of the liquid ceases. The Pharmacopœia states that, when the process is successfully conducted, the first portion of the liquid, or percolate, passing through the percolator, will be nearly saturated with the soluble constituents of the substance treated; and if the quantity of menstruum be sufficient for its exhaustion, the last portion of the percolate will be destitute of color, odor, and taste, other than that possessed by the menstruum itself.

What are the practical details of the process?

The details for conducting percolation perfectly are given in the preliminary notice of the U. S. P., which are as follows:

The Percolator, its Dimensions and Fittings.—The percolator most suitable for the quantities contemplated by the Pharmacopœia should be nearly cylindrical, or slightly conical, with a funnel-shaped termination at the smaller end. The neck of this funnel-end should be rather short, and should gradually and regularly become narrower toward the orifice, so that a perforated cork, bearing a short glass tube, may be tightly wedged into it from within until the end of the cork is flush with its outer edge. The glass tube, which must not protrude

above the inner surface of the cork, should extend from one and one-eighth to one and one-half inch (3 to 4 centimeters) beyond the outer surface of the cork, and should be provided with a closely fitting rubber tube, at least one-fourth longer than the percolator itself, and ending in another short glass tube, whereby the rubber tube may be so suspended that its orifice shall be above the surface of the menstruum in the percolator, a rubber band holding it in position.

The dimensions of such a percolator, conveniently holding five hundred grammes of powdered material, are preferably the following: Length of body, fourteen inches (36 centimeters); length of neck, two inches (5 centimeters); internal diameter at top, four inches (10 centimeters); internal diameter at beginning of funnel-shaped end, two and one-half inches (6.5 centimeters); internal diameter of the neck, one-half inch (12 millimeters), gradually reduced at the end to two-fifths of an inch (10 millimeters). It is best constructed of glass, but unless so directed, may be constructed of a different material.

The Preparation of the Percolator and Material for Percolation.—The percolator is prepared for percolation by gently pressing a small tuft of cotton into the space of the neck above the cork, and a small layer of clean and dry sand is then poured upon the surface of the cotton to hold it in place.

The powdered substance to be percolated (which must be uniformly of the fineness directed in the formula, and should be perfectly air-dry before it is weighed) is put into a basin, the specified quantity of menstruum is poured on, and it is thoroughly stirred with a spatula, or other suitable instrument, until it appears uniformly moistened. The moist powder is then passed through a coarse sieve—No. 40 powders, and those which are finer, requiring a No. 20 sieve, while No. 30 powders require a No. 15 sieve for this purpose.

Powders of a less degree of fineness usually do not require this additional treatment after the moistening. The moist powder is now transferred to a sheet of thick paper and the whole quantity poured from it into the percolator. It is then shaken down lightly and allowed to remain in that condition for a period varying from fifteen minutes to several hours, unless otherwise directed; after which the powder is pressed, by the aid of a plunger of suitable dimensions, more or less firmly, in proportion to the character of the powdered substance and the alcoholic strength of the menstruum; strongly alcoholic menstrea, as a rule, permitting firmer packing of the powder than the weaker. The percolator is now placed in position for percolation, and, the rubber tube having been fastened at a suitable height, the surface of the powder is covered by an accurately fitting disk of filtering paper, or other suitable material, and a sufficient quantity of the menstruum poured on through a funnel reaching nearly to the surface of the paper. If these conditions are accurately observed, the menstruum will penetrate the powder equally until it has passed into the rubber tube and has reached, in this, the height corresponding to its level in the percolator, which is now closely covered to prevent evaporation, and the apparatus allowed to stand at rest for the time specified in the formula.

The Manipulation of Percolation.—To begin percolation, the rubber tube is lowered and its glass end introduced into the neck of a bottle previously marked for the quantity of liquid to be percolated, if the percolate is to be measured, or of a tared bottle, if the percolate is to be weighed; and by raising or lowering this recipient, the rapidity of percolation may be increased or lessened as may be desirable, observing, however, that the rate of percolation, unless the quantity of material taken in operation is largely in excess of the pharmacopœial quantities, shall not exceed the limit of ten to thirty drops in a minute. A layer of menstruum must constantly be main-

tained above the powder, so as to prevent the access of air to its interstices, until all has been added, or the requisite quantity of percolate has been obtained. This is conveniently accomplished, if the space above the powder will admit of it, by inverting a bottle containing the entire quantity of menstruum over the percolator in such a manner that its mouth may dip beneath the surface of the liquid, the bottle being of such shape that its shoulder will serve as a cover for the percolator.

What is re-percolation?

It is the process of percolating successive portions of powdered drug in such a manner as to make a fluid extract without evaporation. For example: Divide thirty-two parts of powdered drug into four portions of eight parts each. No. 1 is moistened, packed, macerated, and percolated until exhausted. Reserve the first six parts, and use the remainder to macerate No. 2, which, percolate and reserve eight parts; repeat the process with No. 3 and No. 4, reserving eight parts of percolate from each. Mix the reserved portions, thereby making thirty parts total. The weaker percolate of the fourth portion is reserved for subsequent operations, when from each eight parts of drugs eight parts of percolate are obtained. (Dr. Squibb's process.)

It has been proven that the first twelve ounces of percolate contains from seventy to seventy-eight per cent. of the total extract obtainable from sixteen Troy ounces of drug. This process is sometimes called fractional percolation.

Why is percolation sometimes called displacement?

Because of the theory that successive portions of solvent *displace* the portions which preceded them. This is practically only partially the case.

What kinds of materials require fine comminution for percolation, and what require coarse?

Woody materials may be finely powdered; fleshy and easily permeable tissues may be coarsely comminuted.

Why is the powder moistened and afterwards sieved?

As stated under maceration, the cells are softened and expanded. Sifting, after maceration, is necessary to break up the agglutinated lumps and render the powder uniform in character.

Can any powder be percolated successfully without previously macerating?

Substances containing volatile oil and resin, such as ginger (and when the menstruum is light and volatile, as alcohol or ether), are better percolated by first packing the dry powder in a percolator.

What is circulatory displacement?

The substance to be extracted or dissolved is tied in a bag and suspended in the upper part of the menstruum. The heavy extractive matter falls through the liquid to the bottom of the vessel, the lighter menstruum circulating displaces the heavier liquid until the material is exhausted.

From common utensils what may be extemporized as a percolator?

An ordinary funnel or a conical chimney of a lamp makes a very good percolator for small quantities.

Why should the general shape of a percolator be tall and narrow?

Because it is desirable that the menstruum should traverse a long column of powder.

Vaporization.

What pharmaceutical operations does vaporization include?

It includes the three operations—evaporation, distillation and sublimation.

Which of these are commonly used in the treatment of organic material?

Evaporation and distillation. (Sublimation is largely employed in the treatment of inorganic material.)

What apparatus is required for conducting the first named operation?

Evaporating dishes.

Mention some of the principles involved in these processes.

The quantity of vapor that will form in a confined space is constant for the temperature, and when an atmosphere is saturated, vaporization ceases unless some circumstances concur to remove a portion of the vapor by condensation.

Rapidity of evaporation is influenced by the state of saturation of the air in contact, being inversely as the quantity of vapor existing in it, when the liquid does not boil.

The boiling points of homogeneous liquids are uniform, provided the pressure is the same; but, if solid matter is in solution, the temperature rises until saturation is attained. Liquids in vaporizing render a large amount of heat latent, which, on condensation, becomes again sensible.

The boiling point rises owing to pressure when a liquid is heated in a tight vessel.

The boiling point is affected by the cohesion and depth of the liquid, and by the nature of the material and surface of the vessel.

Evaporation below boiling is in ratio to the extent of surface exposed to the air.

Evaporation by boiling is in ratio to the extent of surface of the vessel exposed to heat.

What are the various modes of evaporation?

Spontaneous evaporation in vacuo; over lime or sulphuric acid, at the common temperature (processes chiefly used in analytical operations.)

Spontaneous evaporation in the open air, in shallow vessels or on a revolving cylinder.

Evaporation by heat, artificially applied, varying from 100° to 212° F.

Evaporation in vacuo with steam heat, so as to boil at a low temperature.

What precaution is necessary in evaporating certain liquids?

Solutions of aromatics require a gentle heat, the same may be said of fluids and solid extracts, but solutions of saline substances may be evaporated to boiling.

What is distillation?

Distillation essentially consists of the conversion of a liquid into its vapor, by the aid of heat, and the recondensation of that vapor into the liquid state by the application of cold. It differs from evaporation merely in its object, which is the volatile liquid, while evaporation rejects this and secures the residue.

What apparatus is required to conduct this operation?

It requires for its conduction peculiar forms of apparatus, consisting of a boiler (called a retort), a condensing surface, and a vapor-tight communication between the two.

What is a retort?

A plain retort is a flask having a neck so curved that it inclines downward when the body of the flask rests upon a stove or other support and ready for distillation. The neck so bent becomes the exit tube of the apparatus. A *tubulated* retort is provided with an opening at the top, into which is fitted a glass stopper. This convenience allows the apparatus to be refilled with a continuous supply while in operation.

What is a condenser?

A condenser is usually composed of a glass tube surrounded by and fitted to a somewhat shorter and much larger tube. Into the lower end of this second tube there is an opening for receiving a cool stream of water, and at the other end and opposite side there is an opening for the exit of the water warmed in transit; the longer interior tube is thus chilled, and, receiving the steam, condenses the same along its interior wall. A Leibig's condenser answers to the above description.

What is a receiver ?

A flask the neck of which tapers to fit the exit tube of the retort. When the receiver has an opening at the top it is called *tubulated*; if opened at the bottom and tapering, for the purpose of measuring the distillate, it is called *quilled*.

What is a still ?

These are modified forms of the old "Alembic" retort. The exit tube is usually connected with a spiral coil of pipe immersed in water to condense its vapors. Remington's Pharmaceutical Still and others have improved condensers, which make condensation more rapid and perfect than the old way.

What is fractional distillation ?

Fractional distillation consists in collecting in different vessels distillates which come over between certain given temperatures.

What is destructive distillation ?

Destructive distillation takes place when dry organic substances placed in a retort are heated to redness, so as to destroy existing compounds.

What are the distinctive characters of products of distillation ?

They are free from sediment and entirely volatile.

What is sublimation ?

Sublimation differs from distillation from the fact that the product is always solid and generally crystalline. Its object is either to purify volatile solids from fixed impurities or, as a means of obtaining volatile substances in process of manufacture. It is usually conducted on a large scale.

What apparatus is used in conducting this process ?

Retorts and hoods of various patterns. On a large scale, the vapor resulting from sublimation is frequently conducted

and condensed in large chambers especially arranged for the purpose.

What kind of preparations are made by this process ?

There are organic and inorganic products made by sublimation, such as benzoic acid, camphor, arsenious acid, carbonate and chloride of ammonia ; calomel, iodine and sulphur.

What is the characteristic quality of all products of sublimation ?

They should be entirely volatile, some at ordinary temperatures, others only at higher heat.

Other Processes of Separation.

Colation, Filtration, Clarification, Decantation.

What is meant by colation or straining, and what materials are used for this purpose in pharmacy ?

It is a kind of filtration, used for separating insoluble impurities and foreign ingredients. Coarse linen is sometimes employed, especially when pressure is exerted. Clearer products are obtained by using several thicknesses of flannel, with the nap on the inside, without pressure. Muslin, felt, gauze and bolting cloth are also used.

What is the nature and object of filtration ?

Filtration consists in passing a liquid through a porous medium, with the object of separating suspended and insoluble substances from dissolved matter. The liquid passing through the medium (filter) is called the filtrate.

The filtrate is supposed to be generally rendered transparent.

How may filtration be expedited ?

By the use of different kinds of filtering media ; by arrangements for keeping the filter constantly full ; by increasing the pressure of the liquid upon the filtering medium and by maintaining an increased temperature.

How is paper pulp best prepared?

By beating filter paper in a mortar with water or with liquor potassæ, washing the product with water and drying.

Of what other substances are filters made?

Sand, asbestos, ground glass, charcoal, porous stone, etc.

How can the pressure of the atmosphere be increased upon the liquid?

By producing a partial vacuum below the filter and its supports (*e. g.*, a funnel); this can be done by a vacuum pump or other device, such as a column of water falling through a tube, etc., (filter pumps of the catalogues).

What is clarification?

This process is employed when the impurities to be separated are deposited, on account of their greater specific gravity, or by being rendered heavier on the application of heat or dilution with water, or when, by the addition of a foreign substance, they are aggregated together and separated as a coagulum. (See also *Liq. Guttæ Percha.*)

What foreign substances are employed in clarification?

Albumin (added to the liquid and heat applied) produces a scum, which, in rising, carries up with it the enveloped particles.

Gelatin (added to cloudy solutions containing tannin) produces a heavy precipitate, carrying with it the impurities.

Milk (added to some wines) produces a coagulum which envelops and separates impurities. Paper pulp agitated with the liquid and strained retains suspended matters.

How is clarification effected by fermentation?

Natural juices of plants become clarified by virtue of the alcohol developed in fermentation, the insoluble substances being deposited.

What is decantation, and how is the process conducted?

It is the separation of a fluid from a solid which has de-

posited in a vessel. It may be accomplished either by simply tilting the vessel or by the use of a syphon. In the former case a glass guiding rod is used to prevent dribbling of the liquid and to convey away the liquid decanted into any receptacle without loss. The rod is held in a vertical position, against the rim of the vessel, or in advance of the flowing stream of liquid to be decanted. Care is taken in the operation not to disturb the deposit.

What is a siphon, and explain its action?

A bent tube, having one arm shorter than the other; when filled with a liquid and the short arm immersed below the surface of a fluid, and the discharging orifice placed in a lower position than the former, a flow takes place. Atmospheric pressure forces the liquid up the shorter arm, while the excess of weight of the liquid in the longer arm causes a continuous flow.

What rules should be observed in making siphons of great length?

No part of the tube should be higher above the liquid than the point to which that liquid will rise by atmospheric pressure—that is, thirty-three feet for water, thirty inches for mercury, etc.

What is an economical way of making a siphon?

Join two pieces of glass, of unequal length, by means of a piece of India-rubber tubing, just large enough to admit the tube with application of some force. This permits a motion which would break one made entirely of glass.

How are immiscible liquids separated from each other?

If two immiscible liquids (*e. g.*, ether and water) are allowed to stand in a suitable vessel,—separator, or a separating funnel (a funnel with a stop-cock), the lower liquid may be drawn off without disturbing the upper one. If separation is

effected in an ordinary bottle, the upper layer is usually removed by means of a pipette or syringe.

For the separation of what liquids is the Florentine Receiver used?

It is used to separate volatile oils obtained by distillation of aromatic substances with water.

How does decoloration act as a separating process, and how is this process conducted?

Insoluble compounds are formed of coloring matter when solutions of them are brought in contact with porous charcoal.

Therefore by passing (filtering) a colored liquid through animal charcoal the color is removed from the liquid.

What is deodorization and how performed?

It is the process of depriving of odor by means of animal or vegetable charcoal.

To what class of substances are the two preceding processes applied?

Tinctures, oils, saccharine solutions, fatty bodies. Such preparations as deodorized opium and deodorized iodine are made by entirely different processes.

What effect has animal charcoal upon solutions of alkaloids, bitter and astringent, and what pharmaceutical importance is attached?

Charcoal absorbs such proximate principles, hence care should be used in removing coloring from vegetable solutions, that their medicinal quality is not impaired.

CHEMICAL PROCESSES.

(Treatment of mainly inorganic crystalline material.)

What are solutions? Define the process of solution.

Simple solutions are solutions generally of mineral salts of definite strength. Solution is the union of a liquid (the solvent) with another liquid, a solid or a gas, the combination being inseparable without the use of evaporation, distillation,

or chemical means. The union not so intimate, however, as to cause change in color, odor or taste, unless chemical combination, as well as solution takes place. (From a simple solution the solid substances dissolved can be reclaimed, unchanged, by evaporation of the liquid.)

What kind of a solution results when a change of color, odor, or taste, etc., is produced?

A chemical solution.

What solvents are used in making solutions?

Water, alcohol, ether, chloroform, etc.

How is solution aided?

Solutions of solids are generally aided by comminution.

Mention other circumstances which influence solubility and solution.

Heat usually increases the solvent power of liquids, and causes currents and consequent agitation, thus favoring the process of solution; though, as a rule, heat favors solubility, some exceptions to the rule exist, as acetate and citrate of lime. Rapid solution, when not accompanied by chemical reaction, always causes a reduction of temperature, owing to the law that bodies in passing from the solid to the liquid state have their capacity for caloric increased. When dehydrated salts are dissolved there is an increase of temperature. When a gas is to be dissolved in a liquid, cold favors its solution by increasing the specific gravity of the gas, and by counteracting the sensible heat resulting from its condensation.

What effect has the presence of one salt upon the solubility of another salt?

In some cases increasing and in other cases decreasing it. A saturated solution of one salt may be a solvent for another salt—a quality of great value in the removal of impurities from certain salts.

When a salt is said to be soluble, what solvent is meant?

Water.

What is meant by a saturated solution?

A solution is said to be saturated when the substance dissolved ceases to be liquefied by the solvent at common temperatures. Therefore, the real strength of saturated solutions is dependent upon temperature.

What is meant by supersaturated solution, and how is it effected?

When the solvent retains in solution more of the soluble matter than it could under the existing circumstances dissolve, it is said to be supersaturated. It is often effected by heating the solvent to a proper degree and dissolving the substance in it to saturation, then a slow reduction of temperature (without agitating the vessel) will make an over-saturated solution, but a little agitation will start crystallization and throw out the salt in excess of solution.

What is meant by dialysis?

A separation of a crystalloid from a colloid by osmosis.

What is meant by the term crystalloid and colloid?

Those substances which diffuse most rapidly are called crystalloids (crystalline chemical substances), those which diffuse slowly are called colloids (gelatinous substances).

What is meant by the term osmosis, and how is it effected?

A simple dialyser may be made by stretching over the bottom of a sieve frame a piece of parchment or fine membrane. If into the vessel thus made is placed a solution and the whole floated on distilled water, then there is water on one side of the membrane (septum) and the solution on the other; these liquids flow through the membrane at different rates; this is called osmosis. (If the flow of the water into the solution preponderates, it is called endosmosis; if the flow of the solution, it is called exosmosis. The diffusate is found in the distilled water.)

Precipitation.

What is meant by the term precipitation?

When finely divided crystals or amorphous powders are separated from solutions by chemical (or physical) agents, this is termed precipitation. For example; when a solution of carbonate of sodium is added to a solution of chloride of calcium, a precipitate of carbonate of calcium is produced. Light will precipitate solutions of silver and heat will precipitate lime water. The agent producing the precipitation is called the precipitant. The liquid remaining is called the supernatant liquid.

By what terms are the physical characters of precipitates described?

By the terms flocculent, gelatinous, curdy, granular, and crystalline.

What is meant by the term magma?

It is applied to the moist precipitate as it is collected in a filter before it is dried.

By what means may the character of a precipitate be modified?

Hot dense solutions produce heavy precipitates, cold and diluted solutions produce light precipitates.

By what other process can very finely divided products be obtained?

By Elutriation (see *Index*); Levigation (see *Index*).

Crystallization.

What is the usual mode by which a soluble salt is obtained in crystalline form?

Soluble salts are usually crystallized from a saturated solution by slowly evaporating the solvent.

What other modes are used ?

Fusion (example, sulphur), sublimation (ex., benzoic acid), precipitation (ex., mercuric iodide).

What is meant by the terms water of crystallization and efflorescence ?

Water of crystallization is well defined as solid water in a combined state. All water of crystallization is expelled at high temperatures (see Exsiccation) ; but some crystalline substances have it so loosely held that it desiccates at low temperatures, leaving a fine powder behind ; the crystal is then said to be *efflorescent*.

What is deliquescence ?

Absorbing moisture from the air ; such crystals are hygroscopic (carbonate of sodium is efflorescent, but carbonate of potassium is deliquescent).

What is exsiccation ?

Driving off water of crystallization by strongly heating (ex., alumen exsiccatum).

AMORPHOUS.—A non-crystalline substance.

What is meant by the term mother liquor ?

The liquid drained from crystals after they have ceased to form. It frequently contains much of the substance in solution.

What difference is there in the mode of washing precipitates and crystals ?

Crystals are usually washed with the smallest effective quantity of cold water ; precipitates, more copiously with warm water.

How is a crystal bounded ?

By plane surfaces symmetrically arranged with reference to certain imaginary lines passing through its centre ; these lines are called axes.

How are crystalline forms systematically arranged?

They are arranged differently by different authors. The following is one of the best systems of classification:—

Crystals are arranged in six systems, based upon the number and relations of axes, as follows:—

Isometric System.—Three equal axes crossing at right angles (ex., cube).

Tetragonal System.—Two axes equal, third unequal, all crossing at right angles (ex., square prism).

Orthorhombic System.—Three unequal axes, but intersections all at right angles (ex., rectangular prism).

Monoclinic System.—Three unequal axes, one intersection oblique (ex., oblique rectangular prism).

Triclinic System.—Unequal axes all crossing obliquely (ex., oblique rhomboidal prism).

Hexagonal System.—Three equal axes lying in one plane and intersecting at angles of 60° , and a fourth axis crossing each of the others at right angles and longer or shorter (ex., hexagonal prism).

By the truncation and bevelment of the angles and edges of these fundamental forms a vast variety of secondary forms are produced.

What is meant by cleavage?

The tendency to break or cleave along certain planes.

How may the form of a crystal be determined?

In two ways: First, by the regularity of its internal structure or molecular arrangement, as shown by cleavage and the polarization of transmitted light, and, second, by the regularity of external form which follows under favorable conditions, as a necessary consequence of symmetry in arrangement of the molecules.

(For the proper elucidation of the subject of crystallography see Dana's Text Book of Mineralogy.)

How may very large and perfect crystals be formed ?

From cold saturated solutions by slow evaporation ; small crystals are made from rapid cooling of supersaturated solutions.

What is granulation ?

The process of rapidly stirring a solution of a crystalline salt during evaporation until all the liquid is expelled. The residue is a granular powder composed of broken crystals.

Processes Requiring High Heat.**What inorganic substances are made by sublimation ?**

Corrosive sublimate, calomel, chloride of ammonia, iodine, sulphur, etc.

What two kinds of sublimate are there ?

Powder sublimate and cake sublimate. (For process of Sublimation, see *Index*.)

What is ignition ?

Ignition is the process of strongly heating either an organic or inorganic substance, with access of air, the residue left being sought.

What is incineration ?

Incineration is a process similar to ignition ; it is applied to organic substances, with a view to burning the carbonaceous principles, converting them into carbon dioxide, which usually remains in the ash combined with an alkali present.

What is calcination or dehydration ?

It is the process of strongly heating inorganic crystalline substances, with a view to the removal of water, CO_2 , or other volatile constituents, (ex., magnesia).

What is fusion ?

Fusion is the process of liquefying either organic or inorganic substances by heat, (ex., melting of wax).

What is torrefaction or roasting?

It is the process of heating organic substances to change their qualities, by modifying certain constituents without altering others, (ex., torrefied rhubarb).

What is deflagration?

Deflagration is a process of heating one inorganic substance with another capable of yielding oxygen (permanganates, chlorates, nitrates, etc.) which produces sudden combustion without explosion.

What is reduction?

A process of reducing inorganic substances to obtain a lower degree of combination, or the element itself, by the aid of some reducing agent (ex., reduced iron).

What is oxidation?

It is the process of heating with access of air, inorganic substances having a strong affinity for oxygen, which they absorb from the air or chemical compounds (ex., zinc oxide).

What is carbonization?

Carbonization is the process of heating organic substances without access of air, until volatile products are driven off and a charred residue remains, having a black color like charcoal (ex., charcoal).

PHARMACY.—PRACTICAL AND THEORETICAL.

What does the study of pharmacy include?

It largely embraces the study of the Pharmacopœia, the commentaries (dispensatories) upon it, and text-books relating to various branches of sciences necessary to its proper comprehension.

What is a pharmacopœia ?

A pharmacopœia is considered an authoritative guide to the physician and pharmacist regarding the crude drugs and their preparations. It fixes the identity and the standard of quality, purity, and strength of all medicinal substances by means of appropriate titles, definitions, working formulæ and tests. In other countries the work is issued under governmental auspices, and therefore has a certain legal status. The U. S. P. has, like the others, a prestige and professional standing; its legal enforcement is more consistent with a republican form of government. It is revised every ten years by a convention of delegates representing the medical and pharmaceutical professions.

(A dispensatory is a commentary upon one or more pharmacopœias.)

What is meant by the terms official and officinal ?

By official is meant duly authorized; by officinal, recognized by the Pharmacopœia; these two terms are used synonymously by pharmacists.

What may be said of the medicinal value of officinal and non-officinal drugs and preparations ?

The medicinal value of any substance is not directly affirmed by a pharmacopœia, and the absence of mention of any drug or preparation in the Pharmacopœia should not be construed as casting any doubt as to the medicinal value of the same.

How many drugs and medicinal substances of the Pharmacopœia have no officinal preparations made from them ?

There are about 35. (See page 122, those names of drugs in Italics.)

How may the value of officinal organic drugs be shown from a pharmaceutical standpoint ?

The value of drugs from a pharmaceutical standpoint may

be shown as follows: (1) Those entering in but one official preparation; (2) those entering into two official preparations, etc.

Give a list of drugs according to the above classification.

Organic Drugs.*

Contained in one preparation only. (Parts of plants.)

In the Form of Tincture.—Arnicae Flor., Bryonia, Calendula, Carum (Co. Tr. Card.), Cinchona Rubra (Co. Tr. Cinch.), Crocus, Humulus, Kino, Pyrethrum, Santalum Rubrum (Co. Tr. Lav.), Styrax (Co. Tr. Benz.), Sumbul.

Fluid Extract.—Buchu, Castanea, Cornus, Chimaphila, Cypripedium, Dulcamara, Erythroxyton, Eupatorium, Frangula, Guarana, Gossypii Radicis Cortex, Geranium, Grindelia, Hamamelis, Lactucarium, Pareira, Pilocarpus, Rubus, Rumex, Rhus Glabra, Sabina, Scutellaria, Spigelia, Stillingia, Triticum, Uva Ursi, Viburnum, Xanthoxylum.

Extract.—Colocythis, Euonymus, Hæmatoxyton, Juglans, Maltum.

Syrup.—Allium, Amygdala Amara, Gaultheria (Co. Syr. Sar.), Rubus Idæus.

Aromatic Wine.—Absinthium, Lavandula, Origanum, Rosmarinus, Salvia.

Confec. Senna.—Cassia Fistula, Coriandrum, Ficus, Prunum.

Unclassified.—Aurantii Flor. (Water), Chrysarobinum (Ointment), Cetraria (Decoc.), Cydonium (Mucil.), Cinchona (Inf.), Gossypium (Pyroxylin), Mentha Viridis (Sp.), Sinapis Nigra (Must. Pap.), Aspidium (Oleo-resin), Piper (Oleo-resin).

Not Recognized as Parts of Plants.—Copaiba, Gutta Percha, Manna, Mastiche, Gamboge, Pix Canadensis, Scammonium, Oleum Aurantii Florum, Ol. Bergamii, Ol. Cari, Ol. Myristicæ, Ol. Myrciæ, Ol. Sassafras.

* For constituents, active principles, etc., see pages 122-130.

Contained in two preparations. (Parts of plants.)

Amygdala Dulcis (*Mix., Syr.*), Anisum (*Co. Syr. Sarsap., Swt. Tr. Rhei*), Aurantii Dulcis Cortex (*Syr., Tr.*), Belladonna, Folia (*Alcoh. Ext., Tr.*), Brayera (*Fl. Ext., Inf.*), Calamus (*Fl. Ext., Wine Rhei*), Calumba (*Fl. Ext., Tr.*), Cimicifuga (*Fl. Ext., Tr.*), Chirata (*Fl. Ext., Tr.*), Ergota (*Fl. Ext., Wine*), Fennel (*Co. Inf. Senna, Co. Powd. Glycyrrhiza*), Galla (*Tr., Oint.*), Guaiaci Lignum (*Co. Decoc. Sarsap., Co. Syr. Sarsap.*), Gelsemium (*Fl. Ext., Tr.*), Hydrastis (*Fl. Ext. and Tr.*), Ignatia (*Ab., Tr.*), Iris (*Ext., Fl. Ext.*), Leptandra (*Ext., Fl. Ext.*), Menthæ Piperitæ (*Sp., Ar. Wine*), Matico (*Fl. Ext., Tr.*), Limonis Cortex (*Sp., Syr.*), Limonis Succus (*Syr., Mix. Citrate Pot.*), Physostigma (*Ext., Tr.*), Rosa Centifolia (*Water, Co. Syr. Sarsap.*), Taraxacum (*Ext., Fl. Ext.*), Vanilla (*Tro. Iron, Tr.*), Veratrum Viride (*Fl. Ext., Tr.*).

Not Recognized as Parts of Plants.—Amylum (*Iod. Starch., Glycerite*), Catechu (*Tro., Co. Tr.*), Lupulin (*Fl. Ext., Oleoresin*), Opium (*Ext., Powd.*), Pix Liquida (*Syr., Oint.*), Ol. Juniperi, Ol. Terebinthinæ, Ol. Gaultheriæ, Ol. Ricini, Ol. Mentha Viridis Ol. Pimentæ, Ol. Amygdalæ Expressum, Ol. Fœniculi.

Contained in three preparations. (Parts of plants.)

Althæa (*Syr., Mass. Mercury, Pil. Phos.*), Arnicæ Radix (*Tr., Fl. Ext., Ext.*), Belladonna Radix (*Ab., Fl. Ext., Plas.*), Capsicum (*Tr., Fl. Ext., Oleores.*), Caryophyllus (*Co. Tr. Lav., Ar. Tr. Rhei, Wine Opii.*), Cannabis Indica (*Tr., Ext., Fl. Ext.*), Colchici Semen (*Tr., Fl. Ext., Wine*), Cubeba (*Fl. Ext., Oleores., Tr.*), Cinchona Flava (*Tr., Fl. Ext., Ext.*), Colchici Radix (*Ext., Fl. Ext., Wine*), Gentiana (*Tr., Fl. Ext., Ext.*), Jalap (*Ab., Co. Powd., Resin*), Krameria (*Tr., Fl. Ext., Ext.*), Lobelia (*Tr., Fl. Ext., Vinegar*), Prunus Virginiana (*Fl. Ext., Inf., Syr.*), Quassia (*Tr., Ext., Fl. Ext.*), Sanguinaria (*Vinegar, Fl. Ext., Tr.*), Sassafras (*Co. Decoc., Co.*

Fl. Ext., *Co. Syr. Sarsap.*), *Serpentaria* (*Tr.*, *Co. Tr. Cinch.*, *Fl. Ext.*), *Senega* (*Ab.*, *Fl. Ext.*, *Co. Syr. Squill*), *Stramonii Semen* (*Tr.*, *Ext.*, *Fl. Ext.*).

Not Recognized as Parts of Plants.—*Aloes* (*Purified Aloes*, *Aq. Ext.*, *Co. Ext. Colocyn.*), *Ammoniac* (*Mix.*, *Plas.*, *Amm. Plas. with Mer.*), *Benzoinum* (*Co. Tr.*, *Tr.*, *Benzoin. lard*), *Galbanum* (*Plas.*, *Co. Pil.*, *Assaf. Plas.*), *Guaiaci Resina* (*Tr.*, *Amm. Tr.*, *Co. Pil. Antim.*), *Ol. Aurantii Corticis* (*Elixir, Sp.*, *Sp. Myrcia*), *Ol. Cinnamomi* (*Water, Sp.*, *Ar. Sulp. Acid*), *Ol. Limonis* (*Sp.*, *Perf. Sp.*, *Ar. Sp. Amm.*), *Ol. Lavandulæ* (*Co. Tr.*, *Tr. Green Soap*, *Diachylon Oint.*), *Ol. Lavandulæ Flor.* (*Sp.*, *Perf. Sp.*, *Ar. Sp. Amm.*), *Ol. Rosmarini* (*Soap Lin.*, *Perf. Sp.*, *Co. Tr. Laven.*), *Terebinthinæ Canadensis* (*Canth. Paper*, *Flex. Collod.*, *Iron Plas.*).

Contained in four preparations. (Parts of plants.)

Aconitum (*Ab.*, *Ext.*, *Fl. Ext.*, *Tr.*), *Aurantii Amari Cortex* (*Fl. Ext.*, *Tr.*, *Co. Tr. Cinch.*, *Co. Tr. Gen.*), *Conium* (*Ab.*, *Ext.*, *Fl. Ext.*, *Tr.*), *Hyoscyamus* (*Ab.*, *Alcohol. Ext.*, *Fl. Ext.*, *Tr.*), *Ipecacuanha* (*Fl. Ex.*, *Tro.*, *Powd. Ipecac Opii*, *Tro. Morph. Ipecac*), *Mezereum* (*Ext.*, *Fl. Ext.*, *Co. Decoc. Sarsap.*, *Co. Fl. Ext. Sarsap.*), *Nux Vomica* (*Ab.*, *Ext.*, *Fl. Ext.*, *Tr.*), *Podophyllum* (*Ab.*, *Ext.*, *Fl. Ext.*, *Resin*), *Rosa Gallica* (*Fl. Ext.*, *Honey, Confec.*, *Pil. Aloes Mastie*), *Sarsaparilla* (*Co. Decoc.*, *Fl. Ext.*, *Co. Fl. Ext.*, *Co. Syr.*), *Scilla* (*Vinegar, Fl. Ext.*, *Tr.*, *Co. Syr. Squill*), *Valeriana* (*Ab.*, *Fl. Ext.*, *Tr.*, *Amm. Tr.*).

Not Recognized as Parts of Plants.—*Ol. Menthæ Piperitæ* (*Water, Sp.*, *Tro.*, *Co. Pil. Rhei*), *Ol. Anisi* (*Water, Sp.*, *Camp. Tr. Opii*, *Tro. Glycyrr. et Opii*), *Ol. Gossypii Seminis* (*Amm. Lin.*, *Lime Lin.*, *Camph. Lin.*, *Lin. Subacetate Lead*).

Contained in five preparations. (Parts of plants.)

Digitalis (*Ab.*, *Ext.*, *Fl. Ext.*, *Inf.*, *Tr.*).

Not Recognized as Parts of Plants.—*Balsamum Tolutanum* (*Syr.*, *Tr.*, *Pil. Iod. Iron*, *Pil. Phos.*, *Co. Tr. Benzoin*), *Pix*

Burgundica (*Plas.*, *Iron Plas.*, *Galb. Plas.*, *Opium Plas.*, *Pitch Plas. with Canth.*), Resina (*Cerate, Plas.*, *Canth. Plas.*, *Cerate Ext. Canth.*, *Mercury Plas.*).

Contained in six preparations.

Senna (*Fl. Ext.*, *Confec.*, *Co. Inf.*, *Syr.*, *Co. Powd. Glycyrr.*, *Co. Pil. Galbanum*), Zingiber (*Fl. Ext.*, *Oleoresin*, *Tr. Arom. Powd.*, *Co. Powd. Rhei*, *Wine Aloes*).

Not Recognized as Parts of Plants.—Asafoetida (*Mix.*, *Pills, Tr.*, *Plas.*, *Pil. Aloe and Assafoet.*, *Co. Pil. Galbanum*).

Contained in seven preparations.

Myristica (*Vin. Opii.*, *Ar. Powd.*, *Co. Tr. Lav.*, *Ar. Tr. Rhei*, *Tro. Chalk*, *Tro. Mag.*, *Tro. Bicarb. Sodium*).

Not Recognized as Parts of Plants.—Myrrha (*Tr.*, *Co. Mix. Iron*, *Pil. Aloe et Myrrh.*, *Co. Pil. Iron*, *Co. Pil. Galbanum*, *Tr. Aloe, et Myrrh.*, *Co. Pil. Rhei*), Ol. Olive (*Camp. Cerate*, *Spermaceti Cerate*, *Canth. Paper*, *Amm. Plas. with Mer.*, *Mer. Plas.*, *Lead Plas.*, *Diachylon Oint.*).

Contained in eight preparations (parts of plants).

Cardamomum (*Tr.*, *Co. Tr.*, *Ar. Powd.*, *Co. Ext. Colocynth*, *Co. Tr. Gen.*, *Tr. Rhei*, *Swt. Tr. Rhei*, *Wine Aloe*).

Not Recognized as Parts of Plants.—Powdered Opium (*Denarcotized Opium*, *Pills*, *Vinegar*, *Tr.*, *Deod. Tr.*, *Camp. Tr.*, *Wine*, *Powd. Ipecac. et Opii*).

Contained in nine preparations (parts of plants).

Cinnamomum (*Ar. Powd.*, *Inf. Digitalis*, *Syr. Rhei*, *Co. Tr. Card.*, *Co. Tr. Catechu*, *Co. Tr. Lavender*, *Ar. Tr. Rhei*, *Wine Opii*); Rheum (*Ext.*, *Fl. Ext.*, *Pills*, *Co. Pills*, *Co. Powd.*, *Syr.*, *Arom. Tr.*, *Swt. Tr.*, *Wine*, *Tr.*).

Not Recognized as Parts of Plants.—Acacia (*Mucilage*, *Almond Mix.*, *Co. Mix. Glycyrr.*, *Pil. Iod. Iron*, *Pil. Phos.*, *Co. Chalk Powd.*, *Tro. Chalk*, *Tro. Cubeb*, *Tr. Glycyrr. Opii*); Camphora (*Water*, *Lin.*, *Sp.*, *Soap Lin.*, *Camph. Tr. Opii*, *Bellad. Lin.*, *Co. Lin. Mustard*, *Mix. Chloroform*, *Comp. Powd.*).

Morph.); Tragacanth (*Mucilage, Tro. Tan. Acid, Tro. Amm. Cl., Tro. Catechu, Tro. Ipecac, Tro. Krameria, Tro. Pot. Chlorate, Tro. Santoninate Sod., Tro. Ginger.*)

Contained in eleven preparations.

Glycyrrhiza (*Fl. Ext., Pure Ext., Co. Powd., Amm. Glycyrrhizin, Co. Decoc. Sarsap., Co. Fl. Ext. Sarsap., Mass Mercury, Pil. Iod. Iron, Co. Powd. Morph., Co. Syr. Sarsap., Sweet Tr. Rhei.*)

OFFICINAL PREPARATIONS.

Give a synopsis of officinal preparations. (U. S. P.)

Dry preparations (made by simple trituration):—Powders and Triturations.

NON-ALCOHOLIC:—

Waters; Solutions; Infusions; Decoctions; Syrups; Honeys; Mucilages; Mixtures; Glycerites and Vinegars.

ALCOHOLIC AND ETHEREAL:—

Wines; Tinctures; Elixirs; Spirits; Fluid Extracts and Oleoresins.

SOLIDS AND SEMI-SOLIDS:—

Extracts; Abstracts; Resins; Masses; Pills; Troches and Confections.

UNCTUOUS AND OTHER PREPARATIONS FOR LOCAL APPLICATIONS:—

Liniments; Collodions and Oleates; Ointments; Cerates; Suppositories; Plasters and Papers.

PULVERES, Powders (9 off.) consist of dry substances in a pulverized condition. The various ingredients are triturated until thoroughly mixed.

Name the officinal powders and percentage of ingredients.*

Pulvis Antimonialis—*James' Powder*—(Ant. ox. 33, Ca.

* The figures immediately following the name of ingredient indicate the percentage of that ingredient in the preparation indicated.

ppt. phos. 67). P. Aromaticus (Cin. 35, Ginger 35, Card. 15, Nutmeg 15). Creta Compositus (Chalk 30, Acac. 20, Sugar 50). Effervescens Compositus—*Seidlitz Powder*—(Sod. Bic. 40 grs., Sal. Roch. 3ij, mix, wrap in blue paper; Acid Tart., gr. 35, in white). Glycyrrhiza Compositus (Sen. 18, Glycyrr. 16, Fennel 8, Sulph. lot. 8, Sugar 50). Ipecacuanhæ et Opii—*Dover's Powder*—(Ip., Op. āā 10, Sacch. Lac. 80). Jalapæ Compositus (Jal. 35, Cr. Tart. 65). Morphinæ Compositus—*Tully's Powder*—(Morph. Sulph. 1, Camph. 20, Glycyrr. 20, Ca. carb. ppt. 20). Rhei Compositus (Rhub. 25, Magn. 65, Ginger 10).

TRITURATIONES.

Triturations are mixtures of finely triturated medicinal substances and sugar of milk; strength, 10 per cent. of medicinal substance (Ex., Trituration Elaterii).

Non-Alcoholic Preparations.

AQUÆ, Waters (14 off.).

Volatile substances in aqueous solution. Prepared by solution in cold and in hot water; by filtration through impregnated powder, impregnated absorbent cotton and by distillation.

Name the officinal waters and their ingredients.

From Volatile Oil, etc.—Amygd. Amar. 0.1; Anise .2; Cinnamon .2; Fœniculi .2; Menth. Pip. .2; M. Vir. .2; Creosote 1; Camph. 0.8.

From Gases.—Ammon. 10; Ammon. Fort. 28; Chlori 0.4.

Distilled from Flowers.—Aurantii Flor. 40; Rosæ 40.

Aqua Destillata (first distillate and residue [20 per cent.] rejected.)

LIQUORES. Solutions (25 off.).

Non-volatile, chiefly inorganic substances in aqueous solution, one as chloroformic solution of Gutta-percha (9 per cent.).

Give their officinal names, ingredients and percentage.

They may be classified for study as follows:—

Arsenical.—Liq. Acidi Arseniosi; Arsenii et Hydrargyri Iodidi (*Donovan's Solution*); Sodii Arseniatis; Potassii Arseniatis (*Fowler's Solution*), each containing 1 per cent. arsenic.

Alkaline and Earthy.—Liq. Calcis (saturated); Potassæ 5.6; Sodæ 5.6; Ammonii Acetatis (neutral); Pot. Citratis (neutral sol.); Sodæ Chloratæ (*Labarraque's Solution*), 2 per cent. available Cl; Sodii Silicatis (nearly saturated); Magnes. Cit. (effervescent).

Iron.—Liq. Ferri Acetatis 33; F. Chloridi 37.8; F. Cit. 35.5; F. Nitratis 6; F. Subsulphatis 43.7 (*Monsel's Solution*); F. Tersulphatis 28.7; F. et Quininæ Citratis 50 (?).

Lead, Mercury and Zinc.—Liq. Plumbi Subacetatis Dilutus .75; Plumbi Subacet. 25; Hydrargyri Nitratis 50; Liq. Zinci Chloridi (*Burnett's Disinfecting Fluid*) 50 (?)

Miscellaneous.—L. Iodi Compositus (I 5 KI 10); Pep-sini (Pep. 4, HCl. and Glycerine); Liq. Gutta Percha (chloroform solution clarified by PbCO_3).

INFUSII, Infusions (see also page 122 *et seq.*).

Name the officinal infusions giving percentage by weight of ingredients?

With Boiling Water.—Infusum Brayera (*Koosso* 6); Digitalis (Dig. 1.5, Cin. 1.5, Alcohol 7.5); Sennæ Compositus—*Black Draught*—(Senna 6, Manna 12, Mag. Sulph. 12, Fennel 2).

Percolation.—Inf. Cinchonæ (Cinch. 6, Arom. Sulph. Acid); Pruni Virginianæ 4.

DECOCTA, Decoctions (see also page 122 *et seq.*).

Name the officinal decoctions and percentage of ingredients.

Decoctum Cetrariæ, 5; Sarsaparillæ Compositum (Sar. 10, Sas. 2, Guaiac Liq. 2, Glycyrr. 2, Mezereum 1).

SYRUPI, Syrups (34 off.)

* A nearly saturated solution of sugar, the same medicated or flavored. Simple Syrup is a solution of sugar (65) in distilled water (to 100).

Name the official syrups, and percentage of ingredients.

They may be classified as follows:—

Of Inorganic or Crystalline Substances.—Syrupus Calcis (Lime 5); Acidi Citrici (Cit. Acid .8, Sp. Lemon .4); Calcii Lactophosphatis (Ca. ppt. phos. 2.2, Lac. Acid 3.3, Orange Flower 8, HCl, Water of Amm.); Ferri Bromidi (Ferrous Bromide 10); Ferri Iodide (Ferrous Iod. 10); Ferri Quininae et Strychninae Phosphatum (Fe. phos. 1.33, Quinine 1.33, Strychnine .04, Acid. Phos. 8); Hypophosphitum (Hypophosphites Ca 3.5, Na 1.2, K 1.2, Acid. Cit. 1, Spt. Lemon .2); Hypophosphitum cum Ferro (Lactate Iron 1, Syr. Hypophosphites 99); Acidi Hydriodici (Absol. HI Acid 1).

Organic Substances.—(a) Made by the addition of Fluid Extract to simple syrup.*

Ipecacuanhæ 5; Krameria 35; Lactucarii 5; Rosæ 10; Rubi 20; Senegæ 16 (and Aq. Amm. .4); Zingiberis 2.

(b) Containing but one medicinal substance.

Acaciae (Mucil. 25); Allii (Garlic 15, Dil. Acet. Acid 40); Scillæ (Acet. Scillæ 40); Althæa 4; Pruni Virginianæ 12 (and Glycerine 5); Rhei. 9 (and K_2CO_3 .6, Cin. 1.8); Sennæ 33 (and Alcohol 4, Ol. Coriand. .04); Amygdalæ (Sweet 10, Bitter 3); Limonis (Lemon Juice 40, Lemon Peel 2); Aurantii (Sweet Or. Peel 5); Aurantii Florum (Or. Fl. Water 35); Picis Liquidæ 6; Tolutanus 4; Rubi Idæus (40 parts of fermented and filtered raspberry juice).

* The figures immediately following the drug denote the percentage of Fluid Extract or drug contained in the preparation.

(c) Complex or Compound Syrups.—*Rhei Aromaticus* (Arom. Tr. *Rhei* 10); *Sarsaparillæ Compositus* (*Sarsap.* 15, *Guaia.* Lig. 2, *Glycyrrh.* 1.2, *Pale Rose* 1.2, *Senna* 1.2, *Sassafras* .6, *Anisi* .6, *Gaultheria* .6); *Scillæ Compositus* (*Squill* 6, *Senega* 6, *Tart emetic* .15, ppt. *Phos. Ca.* .45).

MELLITÆ, Honeys (3 off).

Name the officinal honeys, and percentage of ingredients.

Mel; *Mel Despumatum*; *Mel Rosæ* (*Red rose* .8 (*Alc. percolate*), *clarified honey* 92).

MUCILAGINES, Mucilages (5 off.)

Solutions of gums or mucilaginous principles.

Name the officinal mucilages, and percentage of ingredients.

Mucilago Acaciæ 34; *Cydonii* 2; *Sassafras Medullæ*, 2; *Tragacanthæ* 6 (and *Glycerine* 18 + heat); *Ulmi* 6 + boiling water.

MISTURÆ, Mixtures (11 off).

Non transparent aqueous preparations holding in suspension insoluble matter (ex., *Mist. Ferri et Ammonii Acetatis*).

In extemporaneous pharmacy how is the term mixture used in its broad sense?

It is applied to every fluid compound intended for internal use, unless it have a distinctive title, as *tincture*, *fluid extract*, etc.

What are emulsions?

Milky mixtures of oil, resin, etc., with water. These immiscible substances are suspended in water by agitating them with mucilaginous substances and the mixture becomes so intimate as not readily to separate.

Mention those officinal mixtures which may be called emulsions, and percentage of ingredients.

Ammoniaci 4; *Asafoetidæ* 4; *Amygdalæ* 6; (and *Acac.* 1 *Sug.* 3); *Chloroformi* 8; (and *Camph.* 2; *Egg yolk* 10).

Mention those containing insoluble powders and percentage of ingredients.

Cretæ—(Pulv. Cretæ Co. 20, Aq. Cin. 40, Aq., 40); Ferri, Composita—(Fe. Sulph. .6, Pot. Carb. .8, Myrrh 1.8, Sug. 1.8, sp. Lav. 5, Aq. Rosæ 90).

What two mixtures contain little or no suspended matter?

Mistura Ferri et Ammonii Acetatis (Basham's mixture), and Rhei et Sodæ.

GLYCERITA, Glycerites (2 off.).

Mixtures of medicinal substances with glycerine.

Give the officinal name and percentage of ingredients in the glycerites.

Glyceritum Amyli (Starch 10, Glycerine, 90); Vitelli (Egg yolk 45, Glycerine 55).

ACETA, Vinegars (4 off.).

Made by treating certain drugs with a menstruum of diluted acetic acid. They all contain 10 per cent. of the drug. Blk. drop contains, beside opium, nutmeg 3, sugar 20.

Mention the officinal vinegars.

Acetum Lobeliæ 10; A. Opii. 10 (Black drop); A. Sanguinariæ 10; A. Scillæ 10.

Alcoholic and Ethereal Preparations.

VINA, Wines (14 off.).

Differ from tinctures in that the *menstruum* is white wine of definite alcoholic strength.

Give the percentage of alcohol in the officinal simple wines.

Vinum Album (White or Sherry Wine), 10–12; Vinum Album Fortius (Stronger White Wine), 20–25; Vinum Rubrum (Red or Port Wine), 10–12.

Give the percentage of ingredients in the medicated wines.

Vinum Aloes 6 (+ Card. 1, Ginger 1); Vinum Antimonii (Tart. Ant. et Pot. 4, Boil Wat. 60); Vinum Aromaticum (Lav., Origan., Pep., Rosemary, Sage, Wormwood, each 1 per cent.); Colchici Radicis 40; Ergotæ 15; Rhei 10 (+ Calamus); Colchici Seminis 15; Opii. 10 (+ Cin., Cloves āā 1); Ferri Amarum (Sol. Cit. Iron and Quinine 8, Tr. Aurant. Dulc. 12, Syr. 36); Ferri Citratis (Cit. Iron Ammon. 4, Tr. Aurant. Dulc. 12, Syr. 12); Ipecacuanha (Fl. Ext. 7).

TINCTURA, Tinctures (72 off.).

Alcoholic solutions of non-volatile substances (exception Tr. Iodi).

What is the general process for making tinctures ?

They are prepared usually by percolating a drug with a strong or weak alcoholic menstruum. (Glycerine, in some cases, is added.)

What are some of the exceptions to the general rule of percolation?

Some are prepared by maceration: ex., Asafœt., Benz., Benz. Co., Fresh Herbs, Guaiac, Guaiac Amm., Kino, Myrrha, Op. Camph., Valerian Amm.

By solution or dilution: Ferri Acetatis, Ferri Chloridi, Iodi.

Name all the simple tinctures having alcohol and dilute alcohol as a menstruum, and percentage of ingredient.*

Cantharidis 5; Iodi 8; Bryoniæ, Physostigmæ, Sumbul, Tolu, *Arnica Radicis*, *Chirata*, *Croci*, *Cubebæ*, *Matico*, *Moschi*, *Quassia*, *Serpentaria*, *Stramonii Semen*, *Opii*, each 10 per cent.; *Rhei* 12; *Gelsemii* 15; *Belladonnæ*, *Cardamomi*, *Colchici*, *Conii*, *Digitalis*, *Hyoscyami*, *Scillæ*, each 15 per cent.; *Aurantii Dulcis*, *Asafœtidæ*, *Benzoini*, *Cannabis Indicæ*, *Cimicifuga*, *Guaiaci*, *Myrrhæ*, *Pyrethri*, *Zingiberis*,

* Those in italics are of dilute alcohol.

Aloes, *Arnicae Flores*, *Aurantii Amara*, *Calendulae*, *Humuli*, *Hydrastis*, *Krameriae*, *Lobeliae*, each 20 per cent. Ferri Chloridi 35; Aconite 40; Ferri Acetatis 50; Veratri Viridi 50; Herb. Recentum 50; Saponis Viridi 65.

Name the percentage of drug and proportion of alcohol and water in the remaining simple tinctures.

Capsici 5, A. 95, W. 5; Vanillae 10, A. 2, W. 1; Calumbae 10, A. 3, W. 2; Cinnamomi 10, A. 3, W. 2; Ignatiae 10, A. 8, W. 1; Opii Deodorata 10, A. 2, W. 8; Sanguinariae 15, A. 2, W. 1; Nucis Vomica 20, A. 8, W. 1; Valerianae 20, A. 2, W. 1.

Name the simple tinctures and percentage strength of tinctures which have various other menstrua.*

Kino 10, A. 60, W. 15, Glyc. 15; *Gallae* 20, Glyc. 10, Cinchonae 20, A. 65, W. 25, Glyc. 10, Guaiaci Ammont. 20. Mens.—Sp. Amm. Ar.; Valerianae Ammont. 20. Mens.—Sp. Amm. Ar.

Name the complex and compound tinctures, with percentage of ingredient and menstruum used.*

Opii Camph. 1.6 = (Pwd. Op. .4, Benz. Ac. .4, Ol. Anisi .4, Camp. .4, Glycerin .4); *Lavand. Co.* 5, A. 68, W. 27 = (Ol. Lav. .8, Ol. Rosmar. .2, Cinnam. 1.8, Cloves .4, Nutmeg 1, Red Saunders .8); *Cardamon Co.* = (+ Glyc. 6, Card. 2, Cinnam. 2, Caraway 1, Cochineal .5); *Gentian Co.* 14 = (Gen. 8, Bt. Or. Pl. 4, Card. 2); *Rhei Dulcis*, 17 = (Rheum 8, Glycyrr. 4, Anise 4, Cardamon 1); *Aloes et Myrrhæ* 20 = (Aloes 10, Myrrh 10); *Catechu Co.* 20 = (Cat. 12, Cin. 8); *Ipecac et Opii* 20 = (Ex. Ipec. Fl. 10, Tr. Opii Deod. to 100); *Cinchonæ Co.* 20, A. 80, W. 10, Glc. 10 = (Cinch. Rub. 10, Bt. Or. Pl. 8, *Serpentaria* 2); *Benzoin Co.* = (Benz. 12, Aloes 2, Storax 8, Bals. Tolu 4); *Rhei Aromatica* = (Rheum 20, Cinnam. 4, Cloves 4, Nutmeg 2).

* In all cases, when the name is italicized the menstruum is dil. alcohol.

ELIXIRIA, Elixirs.

Sweetened alcoholic preparations, containing aromatics and minute quantities of medicinal ingredients. The only one off. (Elix. Aurantii, Ol. Orange-peel 1 part, A. 1, W. 3, Sugar 100, to make 300 parts) is intended as a vehicle in making various elixirs. (See Nat. Form.)

SPIRITUS, Spirits (22 off.).

Alcoholic solutions of volatile substances, either solid, liquid or gaseous.

Name the officinal spirits and percentage of ingredient.

Aromatics.—Anisi (Ol. Anisi 10); Aurantii (Ol. Peel 6); Camphoræ 10; Chloroformi 10; Gaultheria (Ol. 3); Juniperi (Ol. 3); Juniperi Compositus (Oil of Juniper .2, Caraway .02, Fennel. 02); Lavendulæ (Ol. Lav. 3); Limonis, *Essence of Lemon* (Ol. 6, Peel, 4); Menthæ Piperitæ, *Ess. of Peppermint* (Ol. Peppermint 10, Peppermint 1); Menthæ Viridis, *Ess. of Spearmint* (Ol. Spearmint 10, Spearmint 1); Myrciæ, *Bay Rum* (Oil of Myrcia 16, Ol. Or. Peel 1, Pimento 1, in 1800); Myristicæ, *Ess. of Nutmeg* (Ol. Nutmeg 3); Odoratus,—Cologne Water = (Oil of Bergamot 1.6, Lemon .8, Rosemary .8, Lavend. Flowers .4, Orange Flowers .4, Acetic Ether .2); Cinnamomi 10.

Crude Alcohols.—Frumenti; Vini Gallici.

Ethereal.—Ætheris (Strong Ether 30); Ætheris Compositus (Strong Ether 30, Ethereal Oil 3); Ætheris Nitrosi = (Crude Ethyl Nitrite 5).

Containing Ammonia.—Ammoniæ (NH₃ 10 per cent.); Ammoniæ Aromaticus (Amm. Carb. 4, Water of Amm. 10, Oils of Lemon 1.2, Lavender Flowers .1, Pimento .1).

EXTRACTA FLUIDA, Fluid extracts (79 off.)

Concentrated tinctures of vegetable drugs of definite strength. 100 grams of the drug are taken and the product is made up to 100 c.c., hence 1 c.c. represents 1 gram of the drug, or, ap-

proximately, 1 minim represents a grain. They are made by percolation (Exception, *Lactucarium*).

What is meant by reserved percolate?

In making *Fl. Ex.*, the 1st 70 to 90 per cent. of the percolate obtained is called the "reserve percolate;" it contains most all the virtues of the drug; no heat is applied to it. It is reserved to be added to the second percolate.

What is meant by the second percolate?

After obtaining a reserve percolate the percolation of the drug is continued till exhausted; the liquid resulting from the latter is called second percolate.

How is concentration effected in making fluid extracts?

Concentration is effected by evaporating (at a temperature of 50° C., or 122° F.) the second percolate to a soft extract. This is added to the reserved percolate and the whole made up to the required bulk by adding sufficient quantity of the menstruum.

What menstrua are more commonly used in making *Fl. Ex.*?

Alcohol and diluted alcohol.

What intermediate strengths of alcohol and water are used?

A. 8, W. 1; A. 3, W. 1; and A. 2, W. 1.

Mention the strength of the menstrua weaker than diluted alcohol.

A. 3, W. 4; A. 2, W. 3; A. 1, W. 2.

Name the other menstrua used in making fluid extracts.

Boiling Water; Ether, Al. and Water; Al., Gly. and Water.

What parts of plants are represented in this class of preparations?

The underground portions of the plants, as the roots, rhizomes, etc., and the upper parts of the plants, as barks, leaves, etc.

Mention those fluid extracts derived from the underground portions of the plants, and state the menstruum in each.*

Aconiti; *Arnica*; Belladonnæ; Calami; Cimicifugæ; Colchici Radicis 2.1 †; *Calumba*; Cypripedii; Gelsemii; *Gentianæ*; *Geranii* (G.); *Glycyrrhizæ*; Gossypii Radicis; A. 65, G. 35; Hydrastis 3.1; Ipecacuanhæ; Iridis 3.1; *Krameria* (G.); *Leptandra* (G.); *Pareira* (G.); Podophylli 3.1; Rhei 3.1; *Rumicis*; Sanguinariæ; Sarsaparillæ, A. 3, W. 6, G. 1; Sarsaparillæ Co., A. 5, W. 6, G. 1; Scillæ; Senega 2.1; Serpentaria 3.1; *Stillingia*; *Spigelia*; Taraxaci 2.3; Tritici 4.1; Valerianæ 2.1; Veratri Viridis; Zingiberis.

Mention those from the upper portions of the plant.

Aromatic Brayera; Buchu 2.1; Cannabis Indicæ; Aurantii Amari, A. 2, W. 1; Capsici; Castanæ, A. 4, W. 1; *Chimaphila* (G.); *Chirata* (G.); Cinchonæ, W. G.; Colchici Seminis, A. 2, W. 1; *Conii*; *Cornus* (G.); Cubebæ; Digitalis, A. 3, W. 1; *Dulcamara*; Ergotæ, A. 3, W. 4; *Erythroxyli*; Eucalypti; *Eupatorii*; Frangulæ, A. 1, W. 2; Grindeliæ, A. 3, W. 1; Guarana, A. 3, W. 1; Hamamelidis, A. 1, W. 2; Hyoseyami, A. 3, W. 1; Lactucarii (Ether), A. 1, W. 3; *Lobelia*; Lupulini; Matico, A. 15, W. 5, G. 2; Mezerei; Nucis Vomicæ, A. 8, W. 1; *Pilocarpi*; *Pruni Virginianæ*, W. 2, G. 1; *Quassia*; *Rhois Glabra* (G.); *Rosæ* (G.); Rubi, A. 9, W. 7, G. 4; Sabinæ; Scutellariæ, A. 1, W. 2; Sennæ, A. 3, W. 4; Stramonii, A. 3, W. 1; *Uvæ Ursi* (G.); Viburni, A. 2, W. 1; Xanthoxyli.

What are the ingredients in extractum sarsaparillæ fluidum compositum?

Sarsap. 75, Glycyrr. 12, Sassafras Bark 10, Mezereum 3 (Mens., Glycer., Alc., and Aq.).

* When the name is in italics, the menstruum is *diluted alcohol*; (G.) indicates that glycerine is added to menstruum. Alcoholic menstruum is indicated by *simply the name* in regular type.

† Read, 2 parts alcohol, 1 part water; and so with like figures following.

OLEO-RESINÆ, Oleoresin (6 off.).

Made by extracting drug by means of stronger ether and distilling off the ether; the semi-fluid residue constitutes the oleoresin (*Aspidium*, *Capsicum*, *Cubeb*, *Lupulin*, *Pepper*, *Ginger*).

SOLIDS AND SEMI-SOLIDS.

EXTRACTA, Extracts (32 off.).

Semi-solid and solid preparations resulting from the evaporation of solutions of vegetable principles.

Give an outline of the process by which they are made.

The drug is extracted about as in fluid extracts. The second percolate is evaporated until its weight is 10 per cent. of the drug used, then mixed with the reserved percolate and the whole evaporated to a soft extract (pilular consistence). The temperature in no case should rise above 50° C. (122° F.).

To ten of the extracts 5 per cent. of the glycerine is added, to prevent hardening. (Two are solid, and two are powdered extracts.)

What menstrua are used in making extracts?

About the same as in fluid extracts. There are a number of extracts, however, having water alone as the menstruum (marked W. in the list below).*

Name the parts of plants represented in this class of preparations and subdivide as in fluid extracts.

Underground Portions of the Plants.—*Aconiti*; *Arnicae Radicis*; *Belladonnæ*, A. 2, W. 1; *Colchici Radicis* (W.); *Gentianæ* (W.); *Glycyrrhizæ* (W.); *Glycyrrhizæ Purum* (W.); *Hyoscyami Alcoholicum*, A. 2, W. 1; *Iridis*, A. 3, W. 1; *Kramerizæ* (W.); *Leptandræ*, A. 2, W. 1; *Podophylli*, A. 3, W. 1; *Rhei*, A. 3, W. 1; *Taraxaci* (Inspis.).

From the Upper Portions of the Plants.—*Aloes Aquosum*

* Italics = Dil. Alcohol; simply name in Roman type = Alcohol.

(W.); *Cannabis Indicæ*; *Cinchonæ*, A. 3, W. 1; *Colocynthis*; *Colocynthis* Comp.; *Conii Alcoholicum*; *Digitalis*, A. 2, W. 1; *Ergotæ*, A. 3, W. 4; *Euonymi*; *Hæmatoxyli* (W.); *Hyoscyami*, A. 2, W. 1; *Juglandis*; *Malti* (W.); *Mezerei*; *Nucis Vomicae*, A. 8, W. 1; *Opii* (W.); *Physostigmatis*; *Quassia* (W.); *Stramonii*.

What are the ingredients in *extractum colocynthis compositum*?

Ext. Colocy. 16, Aloes 50, Card. 6, Resin Scam. 14, Soap 14.

What is an inspissated juice?

It is the expressed juice of the plant evaporated to a pilular consistence (ex., Ext. *Taraxaci*).

ABSTRACTA, Abstracts (11 off.).

An extract of the drug dried and so diluted with sugar of milk that its strength corresponds to twice that of the drug or fluid extract ($\frac{1}{2}$ grain represents the soluble principles of 1 grain of the drug).

Give an outline of the process by which abstracts are prepared.

The drug is exhausted by percolation with alcohol; the concentrated percolate is mixed with sugar of milk and evaporated to dryness at 50° C. (122° F.); the product diluted with sugar of milk to the required weight (*Nux Vomicae* and *Ignatiæ* have A. 8, W. 1 as a menstruum, and *Aconite* has 2 per cent. of Tartaric Acid in its menstruum). (Others off.:—*Bellad.*, *Conium*, *Digital.*, *Hyos.*, *Jalap*, *Podophyl.*, *Senega*, *Valerian*).

In what officinal preparations are chemical substances added to aid in extraction of the drug and to make the soluble principles more permanent?

In all preparations of *Aconite*, 1 part of Ac. Tart. is used to 100 of the drug. Hydrochloric Acid (3 per cent.) is used in making Ex. *Conii* Fld.; Aq. Ammon. (15 per cent.) in Ex.

Glycyrrh. Fld.; (4 per cent.) in Syr. Senegæ; Acetic Acid (15 per cent.) in Ex. Colchici Radicis.

RESINÆ, Resins (4 off.).

Precipitates from concentrated alcoholic tinctures of resinous drugs (exception, Resinæ Copaibæ).

Briefly state how the officinal resins are prepared.

Resinæ Copaibæ (residue from distilled Balsam Copaibæ); Jalapæ (concentrated tincture precipitated by water); Podo-phylli (concentrated tincture precipitated by water, acidulated with HCl); Scammonii (concentrated tincture, made by digesting Scam. in boiling Alc., precipitated by water).

MASSÆ, Pill Masses (3 off.), viz.:—

Massa Copaibæ = (Mg 06, Cop. 94); Massa Ferri Carbo-natis = (FeSO₄ 100 parts, NaCO₃ 110 parts, Honey 38, Sugar 25); Massa Hydrarg = (Hg 33, Glycyrrh. 5, Altheæ 25, Glycerin 3, Honey of Rose 34).

PILULÆ, Pills (15 off.).

Pill masses divided and formed into convenient shape for administration. They should be of such size that at least three or four represent a dose.

What general rule is desirable in making pill masses?

The material should be well powdered and mixed, in order to obtain uniformity of composition, and then the excipient should be added.

What is an excipient, and what rule should be observed in the selection of excipients?

The object of an excipient is mainly to give adhesiveness and plasticity to the mass, without interfering with solubility. The nature of the excipient must vary according to the material to be brought to the massive condition.

Name some common excipients and briefly comment upon them.

Water should be used with powders of a gummy nature.

Syrup, Honey and Glucose should be used when only slight adhesiveness is required.

Glycerine differs from the above, in that it keeps the masses plastic, but is too hygroscopic to be used alone.

Mucilage Acacia, Glycerite of Starch, Tragacanth Paste (made with glycerine and water), etc., are excellent adhesive excipients for friable, non-adhesive powders and crystalloids.

How can camphor, resinous and oily substances be formed into pills?

By the use of special adhesive pastes, soap and skillful use of heat.

What excipients are useful with oxidizable substances?

Resin Cerate, Cocoa Butter, Petrolatum, etc.

Briefly describe how an officinal pill should be made and dispensed.

The mass is made into a cylindrical roll; it is then cut by a pill machine, or otherwise, into the requisite number of parts, each of which is rolled into a spherical form by rotary motion between the thumb and finger. Before dispensing, they are dusted with a suitable powder (lycopodium, rice-flower, althææ, or powdered licorice root). A very good powder is composed of starch, rice-flower, āā ʒss; sach. alb., ʒij; acacia, ʒj.

Mention the officinal pills in which water is used as an excipient.

Aloes; Aloes et Asafœtida; Asafœtida; Opii; Rhei; Aloes et Mastiche; Catharticæ Compositæ; Rhei Compositus.

Mention those in which adhesive material is added.

Syrup: Aloes et Myrrhæ; Ferri Compositus; Galbani Compositus. Confection of Rose: Aloes et Ferri. Tragacanth.: Antimonii Comp. Coated: Ferri Iodidi; Phosphori.

Give a formula for a gelatine coating solution.

Best French Gelatine, 2½ oz., av.; Aq. Dest., fʒvij. Macerate until gelatine softens. Solve by water-bath and add

Powd. Boric Acid, ʒij; then slowly add mucilage acacia, ʒij, and strain.

How are dried powders made into compressed pills?

Compressed Pills may be made extemporaneously by the use of any of the so-called compressed-pill machines. The simplest form consists of a cast-steel hollow cylinder, into the bottom of which is a closely-fitting removable post. The powder is placed in the cylinder, and, by the use of a cylindrical plunger and strong mallet, the powder is compressed by a heavy blow. The lenticular pill thus formed is removed by removing the bottom post and forced out by a slight blow on the plunger.

TROCHISCI, Troches (16 off.).

Lozenges of medicinal substances incorporated with sugar or extract of licorice, made by adding excipients to masses, divided and formed into flat, circular, oblong, etc., pieces, usually weighing from 10 to 20 grains.

How are troches prepared?

By incorporating the ingredients into a plastic mass, rolling into thin sheets, and cutting into proper shape with a lozenge-cutter.

Mention the officinal troches.

Trochisci Acidi Tannici; Ammonii Chloridi; Catechu; Cretæ; Cubebæ; Ferri; Glycyrrhizæ et Opii ($\frac{1}{20}$ gr. ext. opium in each); Ipecacuanhæ; Kramerizæ; Magnesizæ; Menthæ Piperitæ; Morphinæ et Ipecacuanha ($\frac{1}{20}$ gr. Sulph. Morph. in each); Potassii Chloratis; Soda Bicarbonatis; Sodii Santoninatis (1 gr. Sant. Sod. in each); Zingiberis.

CONFECTIONES, Confections (2 off.).

Known also as conserves and electuaries. Saccharine masses, in which one or more medicinal substances are incorporated.

What are the ingredients in the officinal confections?

Confectio Rosæ: Rose 8, Sug. 64, Clar. Hon. 12, Rose W. 16. Confectio Senna: Sen. 10, Coriand. 6, Cas. fist. 16, Tamarind 10, Prune 7, Fig 12, Sug. 50, Water 60.

Unctuous and other Preparations for Local Application.

LINIMENTÆ, Liniments (10 off.).

Solutions of various substances in oily liquids, applied to the skin with friction.

Name and classify the officinal liniments.

Containing Cotton-seed Oil: (Linimentum Ammonię; Calcis; Plumbi Subacetatis, each saponaceous); Camphorę.

Alcoholic: Chloroformi; Saponis; Sinapis Compositum.

Containing Oil Turpentine: Cantharidis; Terebinthinę.

Fluid Extract: Belladonnę (Cam. 5, Ext. Bel. Fld. 95).

COLLODIA, Collodions (4 off.).

Solution of pyroxylin or "gun-cotton" in a mixture of Stronger Ether and Alcohol, and, the same impregnated with medicinal substances. When applied or brushed upon the skin, a film is produced upon the evaporation of the solvent.

Name the officinal collodions and state principal ingredients.

Collodium; Collodium cum Cantharidi (Fl. Col., Canth.); Col. Flexile (Col. Canada Turp., Cast. Oil); Col. Stypticum (Tan. Ac.).

OLEATA, Oleates (2 off.).

Indefinite chemical compounds of oleic acid, alkaloids and metallic bases, made by trituration.

Mention the officinal oleates.

Oleatum Hydrargyri; Veratrinę.

UNGUENTA, Ointments (26 off.).

Soft, fatty mixtures of lard, wax, spermaceti, etc. Applied by inunction on the skin, when they gradually become liquefied.

CERATA, Cerates (8 off.).

Unctuous mixtures, whose fusibility is between plasters and ointments; sufficiently soft to be spread without heat, and firm enough to adhere to the skin without melting.

Name and classify the official ointments and cerates.

Vehicles for medicinal substances.

Ceratum (W. Wax 30, Lard 70); Ceratum Cetacei; Ceratum Resinæ; Unguentum (Y. Wax 1, Lard 4); Aquæ Rosæ (Cold Cream); Adeps Benzoata; Diachylon.

Those in which the medicinal substances are mixed by fusion and digestion.

Cerat. Cantharides (Canth. 35, Y. Wax 20, Res. 20, Lard 25); Cerat. Extracti Cantharidis; Unguentum Mezerei (Fl. Ex. Mez. 25, Lard 30, Y. Wax 12); Ung. Picis Liquidæ.

Those in which the medicinal substances are incorporated by trituration.

Ceratum Camphoræ (Camph. Lin. 3, Ol. Olive 12, Cerate 85); Sabinæ (Fl. Ext. Sab. 25); Unguentum Acidi Carbolici (Carb. Ac. 10); Acidi Gallici 10; Acidi Tannici 10; Belladonnæ (Al. Ext. Bellad. 10); Chrysarobini (Chrys. 10); Gallæ 10; Hydrarg. 50; Hydrargyri Ammonii 10; Hydrargyri Oxid. Flav. 10; Hyd. Oxid. Rub. 10; Iodi 4 KI; Iodoformi 10; Plumbi Carb. 10; Plumbi Iod 10; Potassii Iod. 12; Sod. Hyposulph. 1; Stramonii (Ext. Stram 10); Sulphuris 30; Sulphuris Alkalinus (Sulph. Lot. 30); Veratrinæ 4; Zinci Oxidi 20.

Those in which the fatty ingredient is chemically changed.

Unguentum Hydrargyri Nitratis; Ceratum Plumbi Subacetatis.

SUPPOSITORIA, Suppositories.

Solid bodies in which the medicinal substance is incorporated. The whole formed into a small cone or cylinder for introduction into the rectum, urethra or vagina, thereby producing a specific effect upon the contiguous parts or upon the whole system.

Why is cocoa butter used in suppositories?

It has the property of fusing at the temperature of the body and solidifying at a temperature just below that point.

Give an outline of the preparation of suppositories.

The officinal directions are as follows:—

Mix the medicinal portion (previously brought to a proper consistence, if necessary) with a small quantity of Oil of Theobroma, by rubbing them together, and add the mixture to the remainder of the Oil of Theobroma, previously melted and cooled to the temperature of 35° C. (95° F.). Then mix thoroughly, without applying more heat, and immediately pour the mixture into suitable moulds. The moulds must be kept cold by being placed on ice, or by immersion in ice-cold water; and the inner surface of the moulds should be carefully freed from adhering moisture, before the melted mass is poured in. In the absence of suitable moulds, suppositories may be formed by allowing the mixture, prepared as above, to cool, care being taken to keep the ingredients well mixed, and dividing it into parts, of a definite weight each, which may be made into a conical or other convenient form for a suppository.

Unless otherwise specified, suppositories shall be made to weigh about *fifteen* (15) *grains* or *one* (1) *gramme*.

EMPLASTRA, Plasters (17 off.).

Tenacious, resinous and waxy, solid compounds, adhesive and pliable, but not fusible at the temperature of the body, requiring heat in order to be spread.

What bases are used in plasters ?

Gum Resins, Burgundy Pitch, Resin Plaster and Lead Plaster.

Name the officinal plasters having extractive material incorporated in them.

Belladonnæ (Bellad. root 100, Resin Plaster to 100); Opii (Ext. Op. 6, Burg. Pitch 8, Lead Plaster 76); Capsici (Resin Plaster, Oleoresin Capsicum).

Mention those having metallic or inorganic material incorporated.

Ammoniaci cum Hydrargyro (Sul. 1, Olive Ol. 8, Hg 180, Ammoniac 720, Dil. Acet. Ac., Lead Plas.); Plumbi (Ox. Pb 32, Ol. Olive 60); Ferri (Lead Plaster 70, Can. Turp. 10, Burg. Pitch 40, Hyd. Ox. Iron 10); Hydrargyro (Olive Oil 10, Resin, 10, Hg 30, Lead Plaster 50); Saponis (Soap 10, Lead Plaster 90).

Mention those containing principally resinous substances.

Aromatic Resins.—Asafœtidæ (As. 35, Galb. 15, Alc. 120, Lead Plaster 35, Y. Wax 15); Ammoniaci (an evaporated, dilute acet. ac., emulsion of Ammoniac); Galbani (Gal. 16, Turp. 2, Burg. Pitch 6, Lead Plaster 76).

Pitches.—Picis Burgundicæ (Burg. Pitch 90, Y. Wax 10); Picis Canadensis (C. Pitch 90, Y. Wax 10); Picis cum Cantharide (Cerat. Canth. 8, Burg. Pitch 92).

Mention one containing animal substance.

Ichthyocollæ (Isinglass 10, Gly. 1, Tr. Benzoin, Alcohol).

CHARTA, Papers (3 off.).

Spread paper plasters, the medicinal substances being either spread upon the surface of the paper or the latter saturated with the medicinal substances.

Name the officinal papers and state their ingredients.

Charta Cantharidis (W. Wax 8, Spermaceti 3, Ol. Olive 4,

Canada Turpentine 1, Canthar. 1, Water 10); Potassii Nitratis (Nit. Potas. 20, Dist. W. 80); Sinapis (Blk. Mustard, Benzine, Sol. Gutta Percha).

THE INORGANIC COMPOUNDS.

How may the elements be classified for pharmaceutical study?

The inorganic elements and officinal compounds may be classified as follows:—

(Compounds to be classed under the metallic or basic elements.)

The Inorganic Bases.

ALKALIES: Potassium; Sodium; Lithium; Ammonium.

ALKALINE EARTHS: Barium; Calcium; Magnesium; (Strontium).

ARSENIC GROUP: Arsenic; Antimony; Bismuth.

UNGROUPED: Zinc; Lead; Silver; Gold; Platinum; (Copper and Mercury); (Iron; Manganese and Chromium); Aluminium; Cerium.

Non-metallic Elements.

HALOGENS: Chlorine; Bromine; Iodine.

UNGROUPED: Hydrogen; Nitrogen; Oxygen; Sulphur; Phosphorus; Carbon; Boron; Silicon.

The Inorganic Acids.

Hydrochloric; Hydrobromic; Nitric; Nitro-hydrochloric; Sulphuric; Sulphurous; Phosphoric; Boric; Arsenious; Chromic.

What are the characteristics of the alkalies?

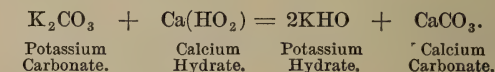
The metals of this group are all soft, fusible and volatile; they decompose water, forming hydrates which are caustic.

They form soluble phosphates, carbonates and arseniates. (The term *alkali* was originally applied to the ashes of sea plants, at length to substances whose solutions have a soap-like action to the skin, etc.; the term at present has a wide significance.)

Name and give the symbol and show by chemical equation the manufacture of the salts of potassium.

(.5)* Potassa, KHO:—

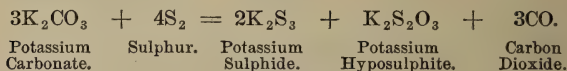
Caustic Potash.



Boiled together.

(2) Potassa Sulphurata:—

Liver of Sulphur.



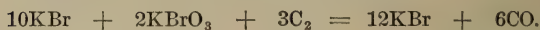
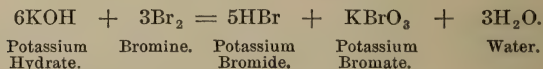
Pot. Sulphurata.

(2.10) Potassii Bitartras, $\text{KHC}_4\text{H}_4\text{O}_6$:—

Cream of Tartar.

Purified argols or tartar.

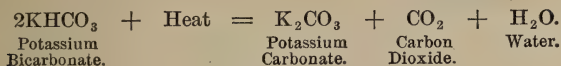
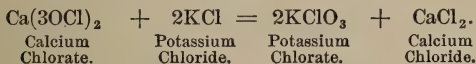
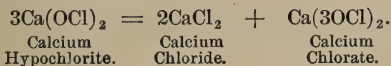
(1.6) Potassii Bromidum, KBr:—



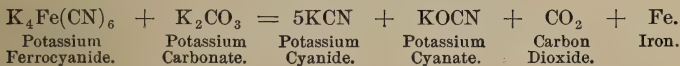
* The figures in front of the name indicate solubility in cold water. Thus .5 indicates that one part is soluble in .5 parts of water.

(1.) Potassii Carbonas (K_2CO_3). $3H_2O$:—

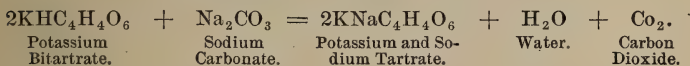
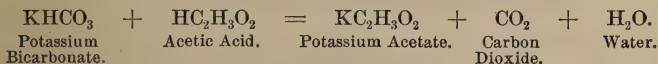
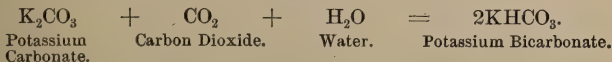
Salts of Tartar.

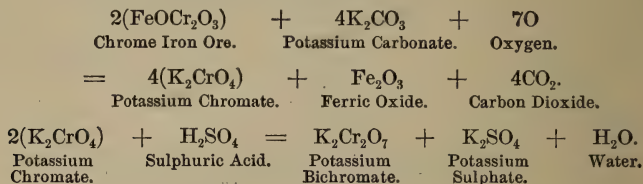
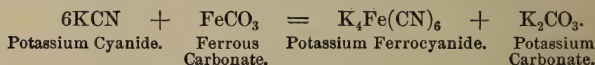
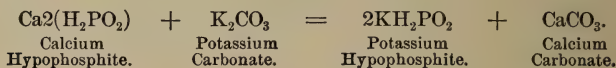
(16.5) Potassii Chloras, $KClO_3$:—(.6) Potassii Citras, $K_3C_6H_5O_7.H_2O$:—

(2.) Potassii Cyanidum, KCN :—

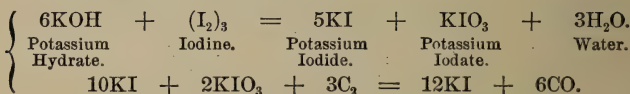
(2.5) Potassii et Sodii Tartras, $KNaC_4H_4O_6.4H_2O$:—

Rochelle Salts.

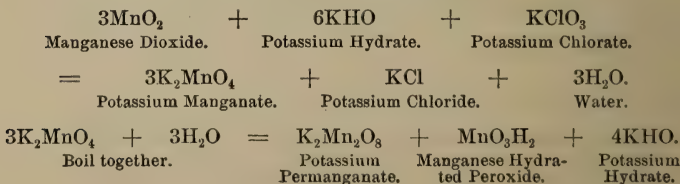
(.4) Potassii Acetas, $KC_2H_3O_2$:—(3.2) Potassii Bicarbonas, $KHCO_3$:—

(10) Potassii Bichromas, $K_2Cr_2O_7$:—(4) Potassii Ferrocyanidum, $K_4Fe(CN)_6 \cdot 3H_2O$:—(6) Potassii Hypophosphis, KH_2PO_2 :—

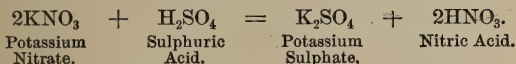
(8) Potassii Iodidum, KI :—



(4) Potassii Nitras (Saltpetre or Nitre), KNO_3 : Natural product; also result of decay of nitrogenous matter in presence of K_2CO_3 , this process being artificially employed for its production.

(20) Potassii Permanganas, $K_2Mn_2O_8$:—

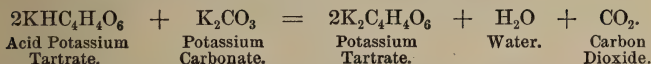
(9) Potassii Sulphas, K_2SO_4 :—



(4) Potassii Sulphis, $K_2SO_3 \cdot 2H_2O$:—



(.7) Potassii Tartras, $(K_2C_4H_4O_6)_2H_2O$:—



Name the officinal preparations of the potassium salts.

Potassa cum Calce (KHO and CaHO, equal parts); Liq. Potassa; Liq. P. Arsenitis; Liq. P. Citratis; Mist. P. Citratis; Troch. P. Chloratis; and Ung. P. Iodidi (see respective preparations).

Potassium salts are contained in what other preparations?

$KNaC_4H_4O_6$, in Seidlitz Powders; KNO_3 , in Argenti Nit. Dilutus and Charta Potassii Nitras; K_2CO_3 , in Mist. Ferri Comp., Syr. Rhei and Ung. Sulph. Alkalinum; $KHCO_3$, in Liq. Magnesii Citratis. $K_4Fe(CN)_6$ is used in making Hydrocyanic Acid, and $KHC_4H_4O_6$ in making Tartrate of Iron and Potassium.

What popular disinfectants are made by the use of potassium hypochlorite and permanganate?

A solution of the former is called Javelle Water; of the latter, Condy's Fluid.

How may KHO be purified?

By Alcohol and Barium Hydrate; thus we have "Potassa by Alcohol," etc.

Why should its solutions be protected from the air?

Because they rapidly absorb CO_2 , forming K_2CO_3 .

How are potassium compounds recognized by chemical tests?

By Platinic Chloride—a yellow, crystalline precipitate; Tartaric Acid in excess—a white precipitate (Cream of Tartar); Flame test, etc.

Why does the U. S. P. direct that the permanganate should be kept in well-stoppered bottles and should not be triturated nor combined in solution with organic or readily oxidizable substances?

Because it is not a stable salt. It readily parts with the comparatively loosely-held oxygen.

RESEARCH QUESTIONS.

To be answered by referring to the U. S. P. or Text-Book.

Observe the strength of the following test solutions of the U. S. P.

Potass. Chromate, P. Bichromate, P. Ferricyanide, P. Ferrocyanide, P. Iodide, P. Sulphate and Potassio-Cupric Tartrate (Fehling's Solution).

Note some instances in which the above solutions are used in testing chemicals and pharmacopœial preparations.

Mention some of the prominent characteristics of potassium salts.

(*Descriptions of salts are found under their respective headings in the U. S. P.*)

[Note that the Bitartrate is soluble in hot and nearly insoluble in cold water; Bichromate is red, Ferrocyanide yellow, Ferricyanide deep red, and Permanganate purple violet; Acetate, Carbonate, Citrate and Cyanide are deliquescent; Iodide very soluble, etc.]

In potassium salts how may the following impurities be detected,—Alkaline earths, metals, silica, chlorine?

More than six per cent. of tartrate *in bitartrate*.

More than one-tenth per cent. of alkali (and more than three per cent. of chloride) *in bromide*.

Bromate and iodide *in bromide*.

Carbonate and tartrate *in citrate*.

Iodate (or over 0.5 of chloride or bromide) *in iodide*.

Calcium *in chlorate and sulphate*.

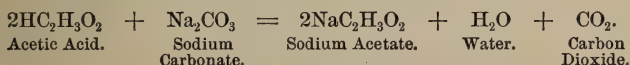
Name, give the symbol, and show by chemical equation the manufacture of the salts of soda.

(1.7) Soda, NaHO :—

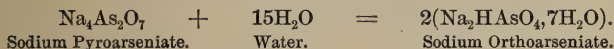
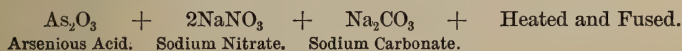
Caustic Soda.



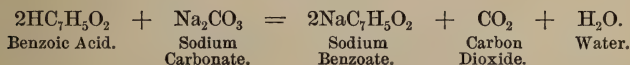
(3) Sodii Acetas, $\text{NaC}_2\text{H}_3\text{O}_2 \cdot 3\text{H}_2\text{O}$:—



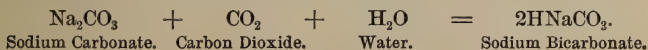
(4) Sodii Arsenias, $\text{Na}_2\text{HASO}_4 \cdot 7\text{H}_2\text{O}$:—



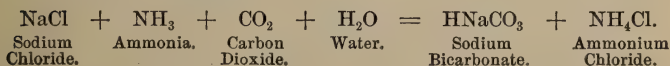
(1.8) Sodii Benzoas, $\text{NaC}_7\text{H}_5\text{O}_2 \cdot \text{H}_2\text{O}$:—



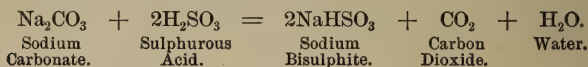
(12) Sodii Bicarbonas, NaHCO_3 :—



Solvay's Method:—



(4) Sodii Bisulphidis, NaHSO_3 :—



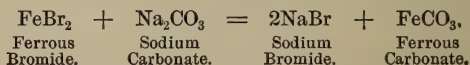
(16) Sodii Boras, $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$: Native product; a crys-

Borax.

talline deposit found on lake shores in California;
also native in Thibet, Persia.

The officinal salt is a recrystallized native salt
(*tincal*).

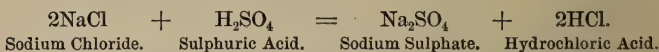
(1.2) Sodii Bromidum, NaBr :—



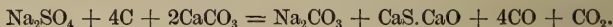
(1.6) Sodii Carbonas, $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$:—

Sal Soda.

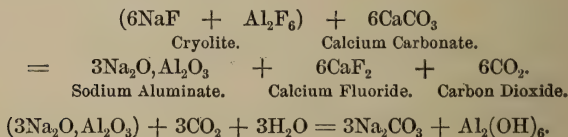
1. Leblanc's Process :—



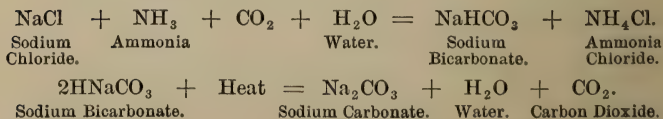
The exsiccated sulphate mixed with chalk and coal and
fused gives the following reaction :—

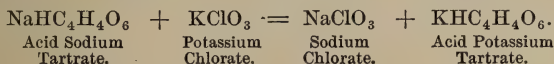
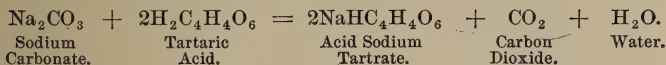


2. Cryolite Process :—

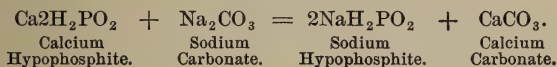
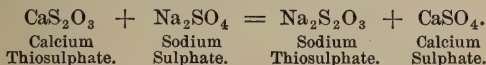
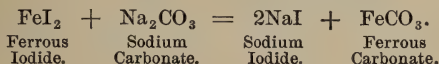
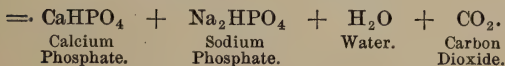
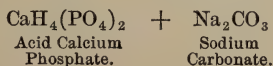
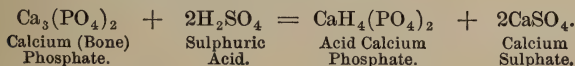


3. Solvay's Process :—

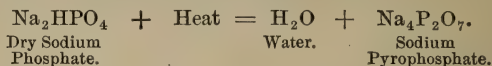


(1.1) Sodii Chloras, NaClO_3 :—(2.8) Sodii Chloridum, NaCl :—Natural product.

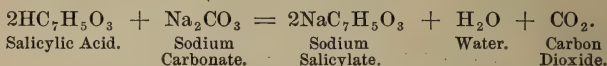
Common Salt.

(1) Sodii Hypophosphis, $\text{NaH}_2\text{PO}_2 \cdot \text{H}_2\text{O}$:—(1.5) Sodii Hyposulphis, $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$:—(.6) Sodii Iodidum, NaI :—(1.3) Sodii Nitras, NaNO_3 :—Natural product.Chili saltpetre or
cubic nitre.(6) Sodii Phosphas, $\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$:—

(12) Sodii Pyrophosphas, $\text{Na}_4\text{P}_2\text{O}_7 \cdot 10\text{H}_2\text{O}$:—



(1.5) Sodii Salicylas, $2\text{NaC}_7\text{H}_5\text{O}_3 \cdot \text{H}_2\text{O}$:—



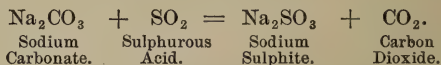
(3) Sodii Santoninas, $2\text{NaC}_{15}\text{H}_{19}\text{O}_4 \cdot 7\text{H}_2\text{O}$:—By adding santonin to hot solution Na_2CO_3 .

(2.8) Sodii Sulphas, $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$:—

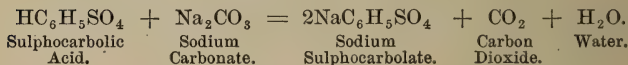
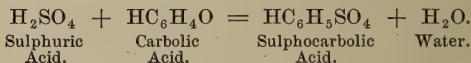
Glauber Salts.

By-product; see Le Blanc's process for Na_2CO_3 .

(4) Sodii Sulphis, $\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$:—



(5) Sodii Sulphocarbolas, $\text{NaC}_6\text{H}_5\text{SO}_4 \cdot 2\text{H}_2\text{O}$:—



Name the officinal preparations of the sodium salts.

Liquor Sodæ; Liq. Sodæ Chloratæ; Liq. Sodii Arseniatis; Liq. Sodii Silicatis; Trochisci Sodii Bicarb.; Tro. Sodii Santoninatis; Mist. Rhei et Sodæ.

Sodium salts are contained in what other preparations?

Sodii Hypophosphis, in Syr. of Hypophosphites; Sodii Pyrophosphate, in Ferric Phosphate and Ferric Pyrophosphate.

What is the officinal name of the commercial baking soda?

Sodii Bicarbonas Venale. (Recently, most of the "Saleratus" is an imperfectly carbonated bicarbonate of sodium, formerly a potassium salt.)

What is dried carbonate of sodium?

The officinal name is Sodii Carbonas Exsiccatus. It is prepared by heating the carbonate of sodium; 200 parts are reduced, by exposing to the air, and afterward heating, to 100 parts.

What is the alternative process for making the solutions of soda and potassa?

Dissolve the caustic hydrates in distilled water (strength of both 5.6 per cent.).

How is the commercial bicarbonate of soda purified?

By washing with water until the washings give no precipitate with magnesium sulphate.

What is sodium hypochlorite, and where found?

NaClO ; contained in liquor soda chlorata.

Name the principal sodium phosphates.

Disodium Phosphate (off. salt); Monosodium Phosphate (NaH_2PO_4), or Acid Sodium Phosphate.

Give the analytical reactions of the sodium salts.

The only reagent producing a precipitate of the Sodium solutions is potassium pyroantimoniate. Sodium compounds give a yellow color to Bunsen flame; Spectrum, a double yellow line. Distinguished from ammonium salts by not being volatilized by heat, and from potassium by not yielding precipitates with PtCl_4 or tartaric acid.

What marked difference is there between the chlorates of sodium and potassium?

The sodium salt is more soluble.

What marked difference is there between the potassium carbonate and the sodium carbonate?

Na_2CO_3 is crystalline and efflorescent, K_2CO_3 is granular and deliquescent. NaHCO_3 is a powder permanent in the air, KHCO_3 is crystalline and slightly deliquescent.

RESEARCH QUESTIONS.

In sodium salts how may the following impurities be detected,—where do they occur?

Alkaline earths, ammonia salts, aluminium, chlorides, iodide, sulphate, bromate, silica, phosphate, calcium, organic matter, foreign impurities. Also note the detection of—

More than three per cent. of carbonate, *in bromide* and *in iodide*.

More than three per cent. of chloride, *in bromide*.

More than five-tenths per cent. of bromide, *in iodide*.

Alkaloids, *in santoninate*.

Sulphate, *in sulphocarbolate*.

Why should not chlorates of potassium or sodium be triturated with readily oxidizable or combustible substances?

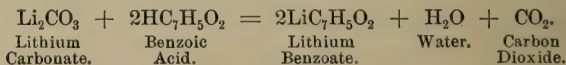
Explosives.

Observe the strength of the following test solutions, and note in what cases they are used in pharmaceutical testing:—

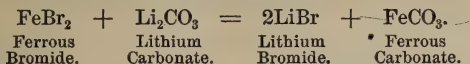
Test of bitartrate, carbonate, hyposulphite and phosphate.

Name and give the symbol, and show by chemical equation the manufacture of the salts of lithium.

(4) Lithii Benzoas, $\text{LiC}_7\text{H}_5\text{O}_2$:—

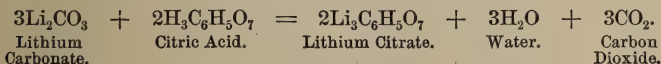


(V. sol.)* Lithii Bromidum, LiBr :—

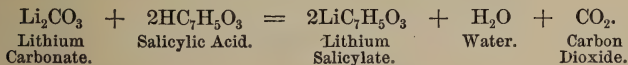


(130) Lithii Carbonas, Li_2CO_3 : Natural product.

(5.5) Lithii Citras, $\text{Li}_3\text{C}_6\text{H}_5\text{O}_7$:—



(V. sol.) Lithii Salicylas, $2\text{LiC}_7\text{H}_5\text{O}_3 \cdot \text{H}_2\text{O}$:—



What importance is attached to lithium in medicine?

If calculi (*e. g.*, urate of sodium, etc.) be formed in the body, their solution and removal are aided by the formation of lithium urate.

For what is the bromide of lithium noted?

For containing more bromine than any other bromide (91.95 per cent.).

What are the characteristics of the lithium salts?

In a non-luminous flame they produce a bright-red coloration, also an intense red line in the spectrum.

RESEARCH QUESTIONS.

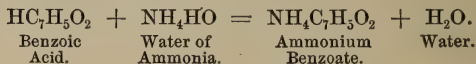
In lithium salts, how may the following impurities be detected?

Salts of the alkalies and alkaline earths, carbonate and foreign matter, *in the Salicylate*.

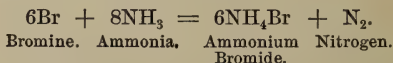
* Very soluble.

Name and give the symbol and show by chemical equation the manufacture of the salts of ammonium.

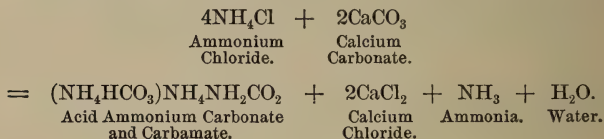
(5) Ammonii Benzoas, $\text{NH}_4\text{C}_7\text{H}_5\text{O}_2$:—



(1.5) Ammonii Bromidum, NH_4Br :—



(4) Ammonii Carbonas, $\text{N}_3\text{H}_{11}\text{C}_2\text{O}_5$ (empirical formula) :—

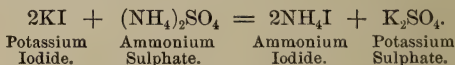


(3) Ammonii Chloridum, NH_4Cl :—

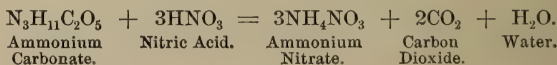
Sal Ammoniac.

By-product in the manufacture of bone-black, and obtained from the ammoniacal liquor in the manufacture of illuminating gas.

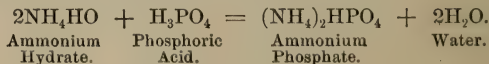
(1) Ammonii Iodidum, NH_4I :—



(.5) Ammonii Nitras, NH_4NO_3 :—



(4) Ammonii Phosphas, $(\text{NH}_4)_2\text{HPO}_4$:—



(1.3) Ammonii Sulphas, $(\text{NH}_4)_2\text{SO}_4$: Ammoniacal gas liquor neutralized with H_2SO_4 , purified by recrystallization.

(V. sol.) Ammonii Valerianas, $\text{NH}_4\text{C}_5\text{H}_9\text{O}_2$: Dry ammonia gas passed into valerianic acid.

Name the officinal preparations of the ammonium compounds.

Liquor Ammonii Acetat.; Troch. Ammonii Chloridi.

In what preparations is aqua ammonia used?

In Sulphurated Antimony; Ammoniated Mercury; Ammoniated Glycyrrhizin; Washed Sulphur; Scaly Salts of Bismuth and Iron; Liniment; Sp. Amm. Ar.; Purified Ext. and Fl. Ext. of Glycyrrhiza; Fl. Ex. and Syr. Senega; (Fortior) in making Spirit. Ammon.

How may carbonate of ammonium be converted into the bicarbonate, and what is a characteristic of the latter?

By simple exposure to the air the crystalline carbonate falls to a powder, becoming bicarbonate, which is insoluble in alcohol.

How may the bicarbonate be converted into the carbonate?

By dissolving in aqua ammonia, as in making the arom. spts. ammon.

This salt is soluble in a mixture of alcohol and water.

Give the analytical reactions of ammonium salts.

Like potassium, they produce the tartaric and platinic reactions, but potassium compounds are not volatile at red heat.

Heated with alkalies the salts evolve NH_3 .

RESEARCH QUESTIONS.

In ammonium salts how are the following impurities detected, and where do they occur?

Ba, Ca, Fe, Pb, CO_2 , Bromate, Iodate, Acetate, and empyreumatic matter.

Also note:—

More than three per cent. of chloride *in bromide*.

More than five per cent. of chloride and bromide *in iodide*.

Observe the strength (and note where used) of the following test solutions:—

Ammon. carbonate, chloride, oxalate, phosphate and sulphide.

Alkaline Earths.

What are the characteristics of this group?

They are bivalent, form basic hydrates, and insoluble carbonates, phosphates and arseniates.

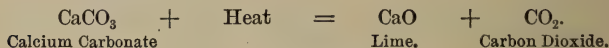
For what purposes are barium salts used?

The solutions of nitrate and chloride are used as test solutions. (See U. S. P.)

Name and give symbol and show by chemical equation the manufacture of the salts of calcium.

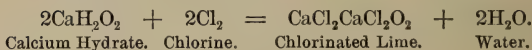
(750) Calx (CaO):—

Quicklime.

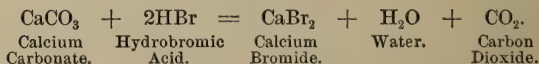


Calx Chlorata, $\text{CaCl}_2\text{CaCl}_2\text{O}_2$:—

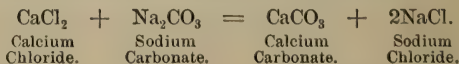
"Chloride of Lime."
Bleaching Powder.



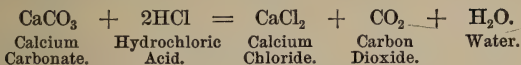
(.7) Calcii Bromidum, CaBr_2 :—



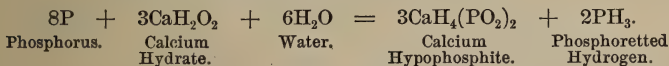
(Insol.) Calcii Carbonas Præcipitatus (CaCO_3):—



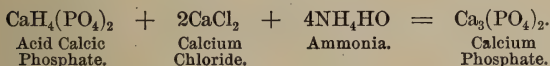
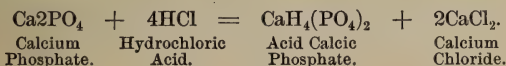
(1.5) Calcii Chloridum, CaCl_2 :—



(6.8) Calcii Hypophosphis, $\text{CaH}_4(\text{PO}_2)_2$:—



(Insol.) Calcii Phosphas Præcipitatus, $\text{Ca}_3(\text{PO}_4)_2$:—



What are the analytical reactions of calcium ?

Alkaline carbonates and phosphates produce precipitates; ammonium oxalate gives a white precipitate with Ca salts, insoluble in weaker acids, but soluble in strong HCl or HNO_3 . Sodium tungstate gives a dense white precipitate; Ca salts color a non-luminous flame red.

Name the officinal preparations of the calcium salts ?

Calx Sulphurata (Lime 100 parts, Sulph. 90); Cretæ Præparata; Pulv. Cretæ Comp.; Mist. Cretæ; Trochisci Cretæ; Liq. Calcis; Syr. Calcis; Syr. Calcii Lactophosphatis.

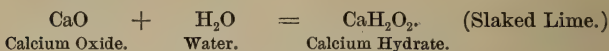
Calcium salts are contained in what other preparations ?

Cretæ Præparata, in Pulv. Cretæ Comp.

What is milk of lime and lime-water ?

The former is a mixture of lime containing particles of undissolved lime; the latter is a clear, saturated solution of lime in water.

Show by chemical equation the action of water upon quick-lime.



How is the value of chlorinated lime estimated?

By estimating the amount of available Cl. (See U. S. P.)

What is whiting?

A cheap form of prepared or elutriated chalk.

For what is chloride of calcium most used in chemistry?

It is used for dehydrating gases; this it does by absorbing water.

Give the chemical name of bone phosphate.

Tricalcic Phosphate $\text{Ca}_3(\text{PO}_4)_2$.

RESEARCH QUESTIONS.

How may the following impurities be detected in calcium salts in which they are found?

Alkalies and their carbonates; bromate; iodide; sulphate; phosphate; chloride; Aluminium; Barium; Magnesium; Iron; Strontium; insoluble matter.

Study the formula of Syr. Lactophosphate of Calcium.

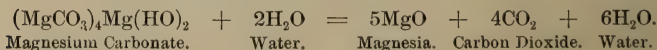
Study the peculiar chemical reaction in making the precipitated Phosphate of Calcium. (Refer to Dispensatory.)

Observe the following test solutions and note where they are used in pharmaceutical testing.

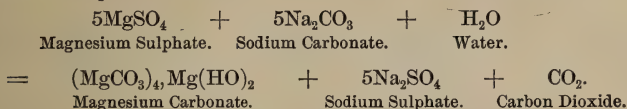
Calcium Chloride, and Sulphate.

Name, give the symbol and show by chemical equation the manufacture of the salts of magnesium.

(Nearly Insol.) Magnesia, MgO :—

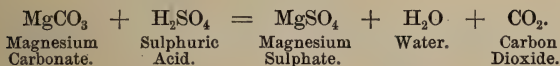


(Nearly Insol.) Magnesii Carbonas, $(\text{MgCO}_3)_4\text{Mg}(\text{HO})_2 \cdot 5\text{H}_2\text{O}$:—



(.8) Magnesii Sulphas, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$:—

Epsom Salts.



(20) Magnesii Sulphis, $\text{MgSO}_3 \cdot 6\text{H}_2\text{O}$: (Magnesia suspended in water and treated with sulphurous acid).

(2) Magnesii Citras Granulatus: Mg Carb., Acid Cit., made into a paste; dried, powdered with sugar and NaHCO_3 and Cit. Acid; dampened with alcohol and granulated.

Name the officinal preparations of the salts of magnesium.

Trochisci Magnesia; Hydrated Oxide of Iron with Magnesia; Liq. Mag. Cit. (Mg Carb. 200 grs., Acid Cit. 400 grs., Syr. Ac. Cit. 1200 grs., NaHCO_3 30 grs., H_2O 12 f3) (sec. art.); Mist. Mag. et Asafoet.

Magnesium salts are found in what other preparations?

MgO , in Pulv. Rhei Co. and Massa Copaib.; MgSO_4 , in Inf. Senna Co.

What is the difference between heavy and light magnesia?

The light (levis) is precipitated from a dilute cold solution.

The heavy (ponderosa) is precipitated from a dense hot solution.

Distinguish, by the taste, oxalic acid, sulphate of zinc and Epsom salts.

Epsom salts has a saline bitter taste, while Zinc has a sharp metallic taste. Oxalic acid has a very sour taste.

What prominent analytical reaction has the magnesium compounds?

Barium and Calcium compounds must be removed by addition of sols. of NH_4Cl , NH_4HO and NH_4CO_3 , the solution filtered; to the filtrate add solution of sodium phosphate, and ammonio-Mg (triple) phosphate is formed.

RESEARCH QUESTIONS.

Name the ingredients in the "test solution of magnesium" and observe where it is used in the U. S. P.

In magnesium salts, how may the following impurities be detected; where do they occur?

Other alkaline earths, SO_4 , Cl , Aluminium, metals. Also note—

Limit of sulphate, *in carbonate of magnesia*.

More than one per cent. of sulphate of alkalies, *in sulphate*.

Arsenic Group.

As	Sb	Bi
Arsenic.	Antimony.	Bismuth.

What are the characteristics of this group?

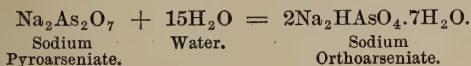
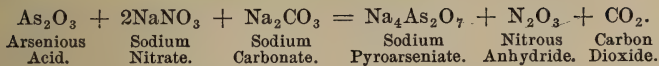
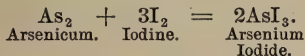
Remarkable for having both basic and acidic properties, Phosphorus being the most negative and Bismuth the most positive; for forming two series of compounds, in one of which they are trivalent and the other quinquivalent; for their poisonous qualities (particularly the two former).

Name, give the symbol and show by chemical equation, the manufacture of the salts of arsenic.

(30-80)* Acidum Arseniosum, As_2O_3 :—



* Solubility varies with physical condition.

(4) Sodii Arsenias, $\text{Na}_2\text{HAsO}_4 \cdot 7\text{H}_2\text{O}$:—(3.5) Arsenii Iodidum, AsI_3 :—

Under what other names is the officinal arsenic known?

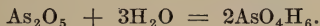
Arsenic Trioxide, Arsenious Anhydride, and improperly, Arsenious Acid and White Arsenic.

What is true arsenious acid?

It has not been isolated; there are, however, a number of salts known as arsenites, having the acid radical represented by AsO_3 , the theoretical arsenious acid.

What is arsenic acid?

A combination of As pentoxide and water; thus,—



What are the officinal preparations of arsenic?

Various solutions (see Liquors) containing one per cent. of Arsenic.

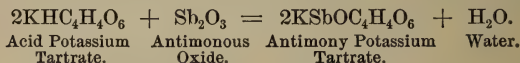
Give the analytical reactions of arsenic compounds.

Reinsch's test, Marsh's test, H_2S to an acidulated solution of (ous) acid produces a yellow ppt. (Orpiment); also silver and copper test.

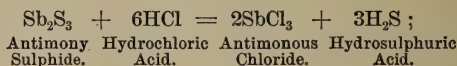
In connection with arsenic the reactions of Antimony, Mercury and Bismuth should be well studied, so that the student may separate them by analysis.

Name, give symbol, and show by chemical equation the manufacture of the salts of antimony.

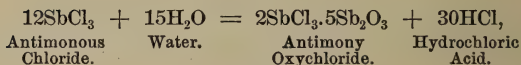
(17) Antimonii et Potassii Tartras, $2\text{KSbOC}_4\text{H}_4\text{O}_6 \cdot \text{H}_2\text{O}$:—



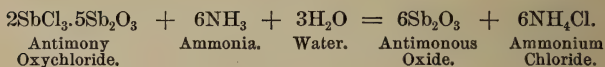
(Insol.) Antimonii Oxidum, Sb_2O_3 :—



then



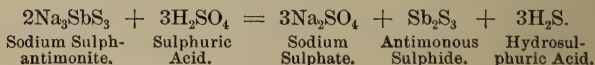
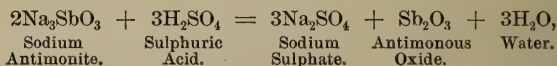
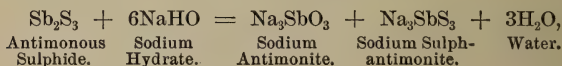
and



(Insol.) Antimonii Sulphidum, Sb_2S_3 :—

Native Sulphide, purified by fusion and as nearly free from Arsenic as possible.

(Insol.) Antimonii Sulphuratum, Sb_2S_3 :—



How is the purified sulphide of antimony made?

First preparing the native sulphide by elutriation and then macerating in water containing a trace of water of ammonia.

Name the officinal preparations of the salts of antimony.

Pilulæ Antimonii Co., Pulvis Antimonialis, Vinum Antimonii.

Antimony salts are contained in what other preparations?

Tart. Emet., in Syr. Scillæ Co. and Vinum; Oxide, in Pulv. Antimonialis; Sb. Sulphuratum in Pil. Ant. Comp.

What is Kermes mineral?

Antimony Oxysulphide of U. S. P. 1870 (replaced in that of 1880 by Antimonium Sulphuratum). (See Pil. Ant. Co.)

Give the analytical reactions of the salts of antimony.

If a piece of tinfoil be dipped in an acidulated sol. of Ant. it will be coated with that metal. By Reinsch's or Marsh's test Antimony (metal) itself must be produced and verified with ammonium sulphhydrate in all cases of analysis.

RESEARCH QUESTIONS.

How may the following impurities be detected in antimony compounds, and where do they occur:—

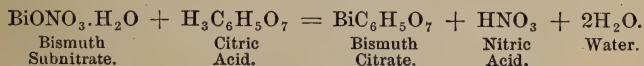
SO₄, Fe, metals, Ca, Cl.

Also detect: more than traces of arsenic in *Tartar emetic* and *purified sulphide*.

Note distinction between sulphide and sulphurated.

Name, give symbol, and show by chemical equation the manufacture of the salts of bismuth.

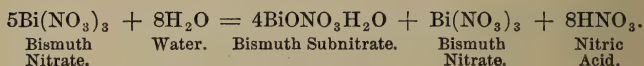
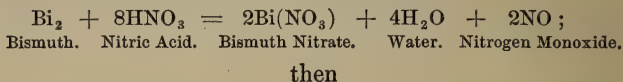
(Insol.) Bismuthi Citras, BiC₆H₅O₇:—



(V. Sol.) Bismuthi et Ammonii Citras:—Citrate of Bismuth dissolved in water of ammonia, evaporated and scaled.

(Insol.) Bismuthi Subcarbonas, $(\text{BiO})_2\text{CO}_3 \cdot \text{H}_2\text{O}$:—Bismuth dissolved in nitric acid, purified and precipitated with sodium carbonate.

(Insol.) Bismuthi Subnitrates, $\text{BiONO}_3 \cdot \text{H}_2\text{O}$:—



How may liquor bismuth be made?

It is an ammoniacal solution of ammonio-citrate of bismuth; strength about 2 grs. to ℥j. (See Dispensatory.)

Explain the loss of transparency in the ammonio-citrate and the solution of bismuth when they are exposed.

It is due to the evaporation of the ammonia; if this is restored to the solution it becomes again transparent.

RESEARCH QUESTIONS.

How may the following impurities of bismuth salts be detected, and where do they occur?

Alkalies, Alkaline earths, Pb, Cu, Ag, Sb, Cl and SO_4 . How can you detect :—

More than traces of As, in the Subnitrate and Subcarbonate.

Zinc.

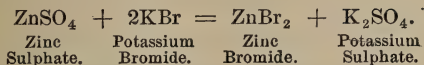
Name, give symbol and show by chemical equation the manufacture of the salts of zinc.

Zincum, Zn:—Metallic zinc in the form of thin sheets or irregular granulated pieces.

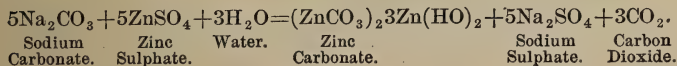
(3) Zinci Acetas, $\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 3\text{H}_2\text{O}$:—



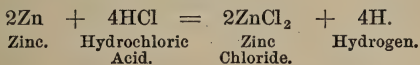
(V. Sol.) Zinci Bromidum, ZnBr_2 :—



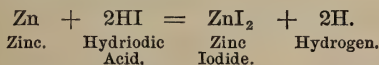
(Insol.) Zinci Carbonas Præcipitatus, $(\text{ZnCO}_3)_2 3\text{Zn}(\text{HO})_2$:—



(V. Sol.) Zinci Chloridum, ZnCl_2 :—



(V. Sol.) Zinci Iodidum, ZnI_2 :—

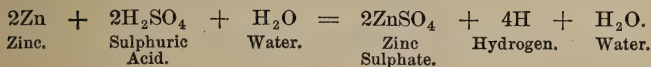


(Insol.) Zinci Oxidum, ZnO :—Zinc carbonate, calcined.

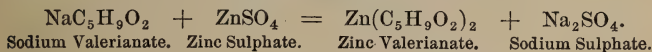
(Insol.) Zinci Phosphidum, Zn_3P_2 :—Made by passing a mixture of PH_3 and N over red-hot Zn in a tube, or by throwing P on melted Zn .

(.6) Zinci Sulphas, ZnSO_4 :—

(White Vitriol.)



(10C) Zinci Valerianas, $\text{Zn}(\text{C}_5\text{H}_9\text{O}_2)_2, \text{H}_2\text{O}$:—



In what officinal preparations are zinc salts employed?

Zn Carb. and Zn , in the Solution of Chloride of Zinc.

Zn Oxide , in the Ointment.

RESEARCH QUESTIONS.

Note the prominent characteristics of acetate and valerianate, the deliquescence of the bromide and chloride.

In zinc salts, how may the following impurities be detected, and when do they occur?

As; Pb; Fe; Cu; Al; Alk. earths; Co_3 .

Basic salts, *in Chloride*.

Butyrate, *in Valerianate*.

Explain how iron is removed from chloride of zinc by the use of HNO_3 and Zn carb.

The HNO_3 oxidizes the Fe, and the Zn Carb. precipitates the ferric hydrate.

Give the analytical reactions of zinc.

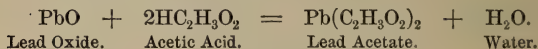
Alkaline hydrates produce a precipitate, soluble in excess; K_2CO_3 and Na_2CO_3 , white precipitate, insoluble in excess; $(\text{NH}_4)_2\text{CO}_3$, white precipitate, soluble in excess. Its sulphide and ferrocyanide are white.

Lead.

Name, give symbol, and show by chemical equation the manufacture of the salts of lead.

(1.8) Plumbi Acetas, $\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 3\text{H}_2\text{O}$:—

Sugar of Lead.



(Insol.) Plumbi Carbonas, $(\text{PbCO}_3)_2 \cdot \text{Pb}(\text{HO})_2$:— Metallic lead acted upon by the fumes of acetic acid and decaying matter; also by dissolving litharge in acetic acid, evaporating and crystallizing.

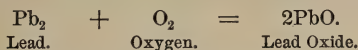
(2000) Plumbi Iodidum, PbI_2 :—



(2) Plumbi Nitras, $\text{Pb}(\text{NO}_3)_2$:—



(Insol.) Plumbi Oxidum, PbO :—



Lead salts are contained in what preparations ?

Emplastrum, made by boiling PbO (Litharge) with olive oil; Liq. Plumbi Subacetat.; Liq. Pb. Subacetat. Dilutus; Cerat. Pb. Subacetat.; Lin. Pb. Subacetat.; Ung. Plumbi Carb.; Ung. Pb. Iod.; Ung. Diachylon. (The Carb. is used in making Sol. Gutta Perchæ.)

RESEARCH QUESTIONS.

Note the sweet taste of sugar of lead and other physical properties.

How may the following impurities be detected; where do they occur?

Zn ; alkalis; alkaline earths; Cu ; CO_3 in the oxide of lead.

What are the analytical reactions of lead compounds?

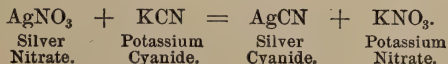
They give from acid solutions a black precipitate with H_2S , insoluble in acids; the same with NH_4S , insoluble in excess. Soluble sulphates produce a white precipitate, KI a yellow precipitate, and KCrO a yellow precipitate.

NOTE :—Test solution of Acetate of Lead.

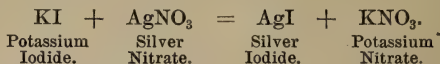
Silver.

Name, give symbol, and show by chemical equation the manufacture of the salts of silver.

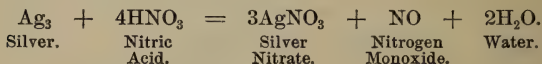
Argentum Cyanidum, AgCn :—



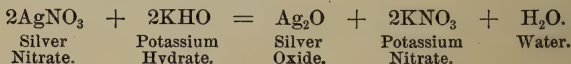
Argenti Iodidum, AgI :—



Argenti Nitras, AgNO₃ :—



Argenti Oxidum, Ag₂O :—



Name the officinal salts of silver not mentioned above.

Argenti Nitras Fusus (nitrate of silver fused and run into moulds); Argenti Nitras Dilutus (equal parts of AgNO₃ and KNO₃ fused together). (AgCN is used in making Ac. Hydrocyan. dilute.)

Why should preparations of Ag be kept in dark, amber-colored vials?

Unless protected from light they turn in color and become chemically changed.

RESEARCH QUESTIONS.

Observe that AgNO₃ has no water of crystallization.

How is the absence of chloride in iodide determined?

What is the quantitative analysis given for AgNO₃ and dilute nitrate?

How is the absence of foreign metallic impurities in AgNO₃ determined?

Observe the strength of the test solution of the AgNO₃ and Ag₂SO₄ and volumetric sol. of AgNO₃.

Of what is the chloride of gold and soda composed?

A mixture of equal parts of the two salts.

For what is platinic chloride used?

As a test solution (see U. S. P.) for the presence of compounds of K and NH_4 .

What precautions should be exercised in using platinum vessels?

The metal is attacked by nitro-hydrochloric acid, or any substance liberating chlorine. They should not be heated with any metal or easily-reducible oxide, or with the alkalies and alkaline carbonates, and under certain conditions, alkaline phosphates. They should never be heated over an alcohol or coal fire; the metal when so heated becomes blackened and brittle.

Copper and Mercury.

What similarity is there in the nomenclature of these two elements?

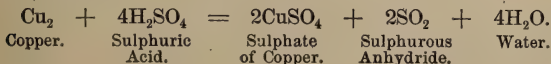
The (ic) salts contain a single atom, as CuO (cupric) and HgCl_2 (mercuric chloride), while the term (ous) applies to compounds containing the greater proportion of metal, as Cu_2O (cuprous oxide), $(\text{Hg})_2\text{Cl}_2$ (mercurous chloride).

Name, give symbol, and show by chemical equation the manufacture of the salts of copper.

Cupri Acetas, $\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{H}_2\text{O}$:—Copper treated with (Verdigris.) acetic acid, and the product purified by crystallization.

Cupri Sulphas, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$:—

(Blue Vitriol.)



In copper salts, how may the following impurities be detected ; where do they occur ?

Alkalies, Alkaline earths, Fe, Pb, Zn, and foreign impurities in *sulphate*.

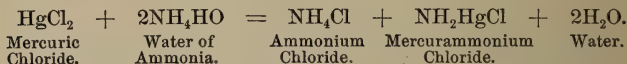
What are the analytical reactions of copper salts ?

Bright metallic iron surfaces become coated with copper when dipped in acidulated solutions of Cu ; H_2S = black ppt. ; NH_4HO = deep blue color ; K Ferro-Cy. = a brown ppt.

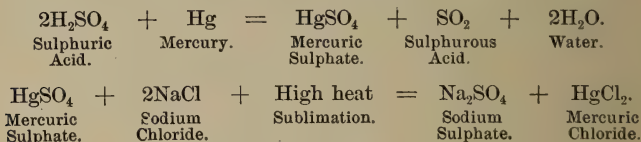
Name, give symbol, and show by chemical equation the manufacture of the salt of mercury.

Hydrargyrum, Hg : With the exception of bromine, Quicksilver. it is the only liquid element at ordinary temperatures. The principal ore of mercury is the native sulphide, known as cinnabar.

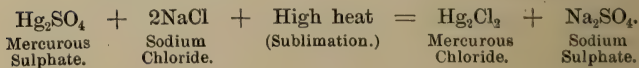
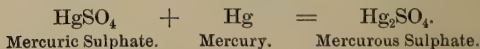
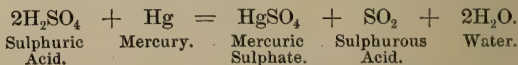
(Insol.) Hydrargyrum Ammoniatum, NH_4HgCl :—



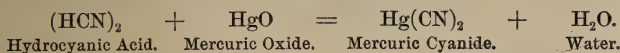
(16) Hydrargyri Chloridum Corrosivum, $HgCl_2$:—



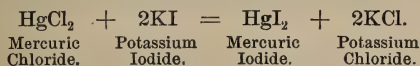
(Insol.) Hydrargyri Chloridum Mite, Hg_2Cl_2 :—



(12.8) Hydrargyri Cyanidum, $\text{Hg}(\text{CN})_2$:—

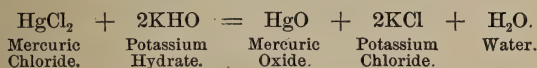


(Insol.) Hydrargyri Iodidum Rubrum, HgI_2 :—

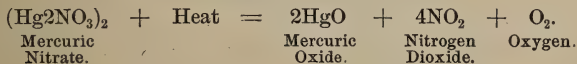


(Insol.) Hydrargyri Iodidum Viride, Hg_2I_2 :—Mercury and iodine rubbed together, with the addition of alcohol.

(Insol.) Hydrargyri Oxidum Flavum, HgO :—



(Insol.) Hydrargyri Oxidum Rubrum, HgO :—



(Insol.) Hydrargyri Subsulphas Flavus, $\text{Hg}(\text{HgO})_2\text{SO}_4$:—By adding mercuric sulphate to boiling water.

(Insol.) Hydrargyri Sulphidum Rubrum, HgS :—Fusing and subliming mercury and sulphur.

Name the plasters containing mercury in metallic state.

Emp. Hydrarg. (30 per cent.), Emp. Amm. cum. Hydrarg. (1.8 per cent.).

Name the ointments of mercury and its salts?

Unguentum Hydrarg., Ung. Hydrarg. Amm., Ung. Hydrarg. Ox. Flav., Ung. Hydrarg. Ox. Rub., Ung. Hydrarg. Nit.

Name the other officinal preparations of Hg.

Hydrarg. Cum Creta, Massa Hydrarg., Oleatum Hydrarg.,

Liq. Hydrarg. Nit. (Hg_2Cl_2 , in Pil. Ant. Co. and Pil. Cath. Co.; HgI_2 , in Donovan's solution).

What is vermilion?

Composed largely of red sulphide of Hg.

RESEARCH QUESTIONS.

Observe the physical properties of the (*ic*) and (*ous*) salts of mercury.

Why is alcohol used in making the iodide.

How are the following impurities detected in mercury salts, and where are they found?

Pb, Sn, As, Sb, and other metals.

Note, also, moisture and organic impurities in metallic mercury; *ous in ic* and *ic in ous* salts.

What are the analytical reactions of mercury?

A piece of bright copper in a solution containing mercury is coated with that metal; if the copper, with its adherent deposit, be washed, dried and heated in a glass tube, minute globules of mercury condense in the cold part of the tube; H_2S = a black precipitate.

NOTE.—Test solutions of Iodides of Mercury and Potassium, and Mercuric Chloride.

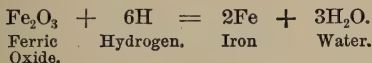
Iron. Manganese and Chromium.

What peculiarity is there in the valence of these elements?

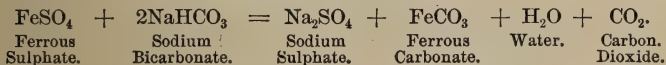
They form two series of compounds designated respectively *ous* and *ic* compounds; in the former the atom is bivalent, as in FeCl_2 , in the latter a double atom (Fe_2) behaves as a hexivalent atom as in $(\text{Fe}_2)\text{Cl}_6$.

Name, give symbol and show by chemical equation the manufacture of the salts of iron.

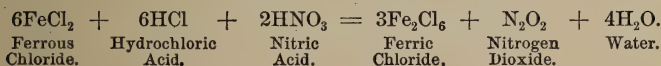
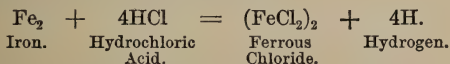
Ferrum Reductum, Fe:—



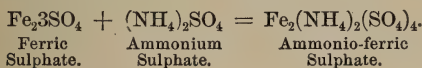
(S. Sol.)* Ferri Carbonas Saccharatus:—



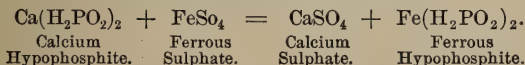
(V. Sol.) Ferri Chloridum, Fe_2Cl_6 :—



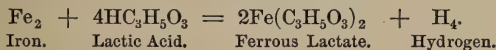
(3) Ferri et Ammonii Sulphas, $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_4, 24\text{H}_2\text{O}$:—
Iron Alum.



(S. Sol.) Ferri Hypophosphis, $\text{Fe}_2(\text{H}_2\text{PO}_2)_6$:—

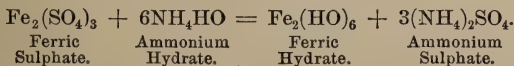


(40) Ferri Lactas, $\text{Fe}(\text{C}_3\text{H}_5\text{O}_3)_2, 3\text{H}_2\text{O}$:—



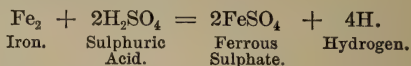
(S. Sol.) Ferri Oxalas, $\text{FeC}_2\text{O}_4, \text{H}_2\text{O}$:—Ferrous Sulphate treated with oxalic acid and the precipitate collected.

(Insol.) Ferri Oxidum Hydratum, $\text{Fe}_2(\text{HO})_6$:—



* Sparingly soluble.

(Sol.) Ferri Sulphas, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$:—



(Insol.) Ferri Valerianas, $\text{Fe}(\text{C}_5\text{H}_9\text{O}_2)_6$:—Double decomposition between ferric sulphate and sodium valerianate.

Give the officinal names of the scale salts of iron.

Ferri Citras, F. et Ammonii Citras, F. et Quiniæ Citras, F. et Strychniæ Citras, F. et Ammonii Tartras, F. Phosphas, F. Pyrophosphas.

Give a general formula for the preparation of the scale salts of iron.

Ferric Hydrate is first made by precipitating a solution of Ferric Sulphate with solution of Ammonia, washing the precipitate, then adding prescribed proportions of the respective acids (tartaric or citric) or acid salt (acid potassium tartrate), etc., evaporating to a syrupy consistence and spreading on plates to dry (or scale).

How are the citrates of iron and strychnine and iron and quinine made?

The former is an evaporated mixture of Citrate of Iron and Ammonia with Citric Acid and Strychnine, the latter is made by dissolving Quinine (alk.) in solution of Ferric Citrate evaporating and scaling.

How is the pyrophosphate and phosphate made?

In the former by mixing the solution of Citrate of Iron and Pyrophosphate of Sodium, in the latter the Cit. of Iron and Phosphate of Sodium evaporating, etc.

Why are the alkaline salts used in these iron preparations?

To make them soluble; such double compounds of Iron are readily dissolved and retained in solution.

What salts of iron are officinal not mentioned above?

Ferri Sulphas Exsiccatus (Sulphate heated till loss of weight ceases).

Ferri Sulphas Præcipitatus (Sulphate dissolved in acidulated (H_2SO_4) water, the solution filtered and precipitated by Alcohol).

Iron salts are contained in what other preparations?

Vinum Ferri Citratis, various Liquors and Syrups (which see) Lactate, in Syr. Hypophosphitum cum Ferro; Fe. Ox. Hyd. in Plaster and Troches; FeSO_4 , in Massa Ferri Carb. and Mist. Ferri. Co.; Ferri Sulphas Exsiccatus, in Pil. Aloes et Ferri; Ferrum reductum, in Pil. Ferri Iod.

What are some of the synonyms of ferric oxide?

Sesquioxide, Peroxide, and Red Oxide of Iron, Colcothar Rouge, Venetian Red, etc.

By what other name is the subsulphate of iron known?

Persulphate and Basic Ferric Sulphate.

Give the analytical reactions for salts of iron.

Ferrous Salts with K Ferro-Cy = a greenish white ppt.; with K Ferri-Cy = blue ppt. (Turnbull's Blue). *Ferric Salts* with Ferro-Cy = blue ppt. (Prussian blue), Ferri-Cy = no ppt., greenish brown color. With ic salts, only, K Sulphocyanate produces a deep red color.

RESEARCH QUESTIONS.

Observe the strength of the following test solutions of the U. S. P.

Ferric Chloride and Ferrous Sulphate.

How is the per cent. of unoxidized sulphate in copperas determined?

In iron salts, how may the following impurities be detected, and where do they occur?

Zn, Cu, Alkalies and NO_3 ; Fe (ous) *in ic*, and Fe (ic) *in ous*.
Al. *in Iron Alum*. Iodine *in Saccharated Iodide of Iron*.

Name, give symbol, and show by chemical equation the manufacture of the salts of manganese.

(Insol.) Mangani Oxidum Nigrum, MnO_2 : Also known as black oxide, is the chief ore of manganese.

(.7) Mangani Sulphas, $\text{MnSO}_4 \cdot 4\text{H}_2\text{O}$.

In what preparations are the manganese compounds used?

MnO_2 , used in making chlorine water, and in permanganate of potassium.

What is a prominent physical property of Mn salts?

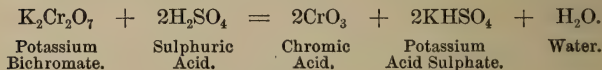
Pinkish in color.

In the sulphate, how may the following impurities be detected?

Zn, Cl, Cu, Alkalies, and Mg.

Name, give symbol, and show by chemical equation the manufacture of officinal compounds of chromium.

Acidum Chromicum, CrO_3 :—



RESEARCH QUESTIONS.

How may H_2SO_4 be detected in chromic acid?

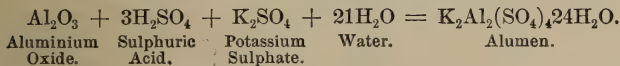
What is the effect and danger of mixing the above with oxidizable bodies?

Aluminium.

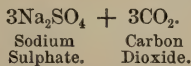
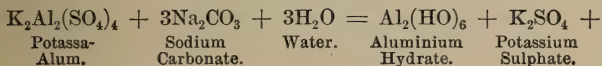
Name, give symbol, and show by chemical equation the manufacture of the salts of aluminium.

(10.5) Alumen, $K_2Al_2(SO_4)_4 \cdot 24H_2O$:—

Potassa-alum.



(Insol.) Aluminii Hydras, $Al_2(HO)_6$:—



(1.2) Aluminii Sulphas, $Al_2(SO_4)_3 \cdot 18H_2O$:—Aluminium hydrate treated with sulphuric acid and crystallized.

What is dried or burnt alum ?

Alumen exsiccatum is made by heating 184 parts of alum (not above $205^\circ C.$) until reduced to 100 parts.

What other compounds, besides the officinal alum, are termed alums ?

The officinal alum is known as the Potassa-alum, but any double sulphate of a trivalent and a univalent radical with 24 molecules of water of crystallization is considered an alum. We have, therefore, besides Potassa-alum, Ammonia-alum; NH_4 , replacing the univalent K, thus: $Al_2(NH_4)_2(SO_4)_4 \cdot 24H_2O$. We have also double sulphates of Cr, Fe, Mn (replacing the Al), and an alkali metal, plus $24H_2O$. All these are termed alums.

Give the analytical reactions of the aluminium compounds.

Hydrates of K and Na produce white, gelatinous precipitates soluble in excess ; alkaline carbonates produce precipi-

tates, with evolution of CO_2 ; NH_4 produces a white precipitate insoluble in excess.

RESEARCH QUESTIONS.

In aluminium salts, how may the following impurities be detected? Where are they found?

Alkalies, Fe, Pb, Zn; SO_4 *in hydrate*.

More than 5 per cent. of alkaline sulphate, *in sulphate*.

Name, give symbol and method of preparation of the officinal salt of cerium.

(Insol.) Cerii Oxalas, $\text{Ce}_2(\text{C}_2\text{O}_4)_3 \cdot 9\text{H}_2\text{O}$:—Cerium chloride precipitated by oxalic acid.

RESEARCH QUESTION.

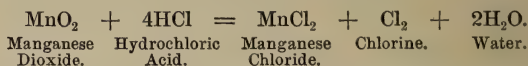
In cerium salts, how may the following impurities be detected; where do they occur?

Al, Zn, CO_3 , metals.

Non-metallic Elements.

Halogens:—Chlorine, Bromine and Iodine.

How may chlorine be separated from HCl ?



(Officinal preparations of Cl:—Calx Chlorata; Liq. Sodæ Chlorata.)

Give an extemporaneous method of preparing chlorine water.

1. NaCl 60 grs., lead oxide (red) 350 grs.; triturate and introduce into a bottle; add water, ℥viiij , and H_2SO_4 , fʒij , and let stand. (PbSO_4 precipitates, while Cl and NaSO_4 are in solution.)

2. KClO_3 , 60 grs., is put into an 8-oz. bottle; add HCl , f3ij; let stand till reaction ceases, and add water to make one pint.

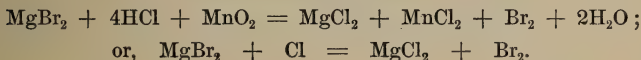
How does Cl act as a bleaching, deodorizing and disinfecting agent?

As an indirect oxidizer by decomposing any water present; the liberated nascent O acting energetically —



How may bromine be separated from its native combination?

It is found as a magnesium or calcium bromide in the mother liquors ("bittern"), separated as follows:—



What are the physical properties of bromine?

It is a dark-brown liquid, volatile, giving off brown fumes, which are disagreeable in odor and irritating to the mucous surfaces.

How is iodine separated from its native combinations?

Crude NaI is decomposed by MnO_2 and H_2SO_4 and sublimed.

State the physical properties of iodine.

Scaly, volatile substance, of acrid odor and taste, having metallic lustre; its fumes violet colored, very sparingly soluble in H_2O .

(Official preparations of Iodine:—Tr.; Liq. Iod. Co.; Ung.; Amylum Iodatum; Syr. Ac. Hydriodici.)

RESEARCH QUESTION.

Give an account of the preparation and use of the volumetric solution of iodine.

ELEMENTARY GASES (H, N, O, Cl).

What are the elementary gases, and give their physical properties?

Hydrogen, Oxygen and Nitrogen are colorless, odorless and tasteless. Chlorine is a yellowish-green gas, of suffocating odor.

Into what officinal compound do these elements enter?

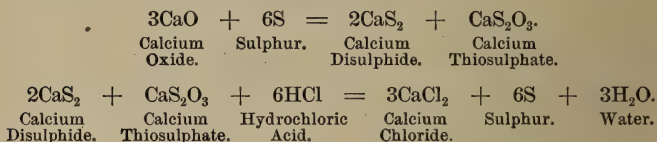
See Inorganic Acids, etc.

What preparations of sulphur are officinal?

(Insol.) Sulphur Sublimatum: By subliming crude sulphur.

(Insol.) Sulphur Lotum: By washing sublimed sulphur.

(Insol.) Sulphur Præcipitatum:—



(Insol.) Sulphuris Iodidum: By treating iodine with sulphur.

Unguentum Sulphuris: 30 parts of sublimed sulphur mixed with 70 parts of benzoinated lard.

Unguentum Sulphuris Alkalinum: 20 parts of washed sulphur, 10 parts of carb. pot., 5 parts water, and 65 parts of benzoinated lard.

(Insol.) Carbonei Bisulphidum: Sulphur vapor passed over red-hot charcoal.

Acidum Hydrosulphuricum (Sulphuretted Hydrogen): Ferrous sulphide acted upon by diluted sulphuric acid.

What preparations of phosphorus are officinal?

Phosphorus: Phosphoric acid deoxidized with carbon.

Oleum Phosphoratum: 1 per cent. of phosphorus dissolved in almond oil.

Pilulæ Phosphori: $\frac{1}{100}$ of a grain of phosphorus contained in each pill.

What preparations of carbon are officinal?

Carbo Animalis: Bones carbonized, air excluded during carbonization ("burning").

Carbo Animalis Purificatus: Animal charcoal purified with HCl and heat.

Carbo Ligni: Wood carbonized as above.

Carbonei Bisulphidum: See preparations of Sulphur.

In making purified animal charcoal, what effect has HCl?

It dissolves out the calcium salts.

By what other names is animal charcoal known?

Ivory black or bone black.

What use has this substance in pharmacy?

It deprives certain kinds of solutions of color (see decolorization).

What preparations of boron are officinal?

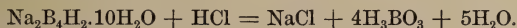
Acidum Boricum, H_3BO_3 : Natural product purified.

(16) **Sodii Boras:** See preparations of Soda.

Borax.

How may boric acid be produced artificially?

By decomposing Borax with HCl, thus:—



Give the analytical test for boric acid?

Alcohol flame turns green with boric acid; Turmeric paper, brown.

What preparations of silicon (or silicium) are officinal?

Liquor Sodii Silicatis, Na_2SiO_3 (soluble glass): Silica fused with dried sodium carbonate and the product dissolved.

By what other name is silica known?

Silicic Oxide, SiO_2 .

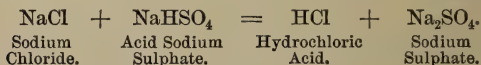
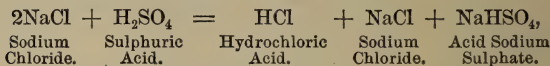
Inorganic Acids.

1. STRONG ACIDS.

Name, give symbol, and show by chemical equation how the inorganic acids are made.

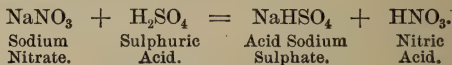
Acidum Hydrochloricum, HCl:—

31.9 per cent. absol. acid.



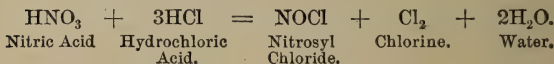
Acidum Nitricum, HNO₃:—

69.4 per cent. absol. acid.



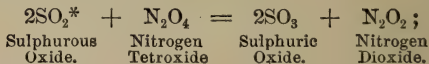
Acidum Nitrohydrochloricum:—

4 parts HNO₃.
15 " HCl.

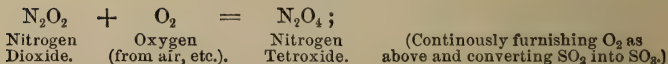


Acidum Sulphuricum, H₂SO₄:—

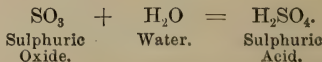
96 per cent. absol. acid.



then



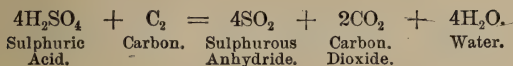
then



* Obtained by heating S, or Iron pyrites, in a current of air.

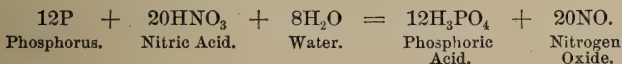
Acidum Sulphurosum, SO_2 :—

3.5 per cent. of (SO_2) gas.



Acidum Phosphoricum, H_3PO_4 :—

50 per cent. absol. acid.



(The other inorganic acids are mentioned under other headings.)

2. DILUTE ACIDS.

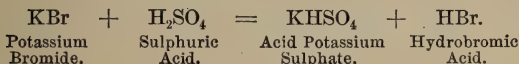
Name and give the mode of preparation of the dilute inorganic acids.

Acidum Hydrochloricum Dilutum: Water and HCl mixed.

10 per cent. absol. acid.

Acidum Hydrobromicum Dilutum, HBr :—

10 per cent. absol. acid.



Acidum Nitricum Dilutum: Water and HNO_3 mixed.

10 per cent. absol. acid.

Acidum Nitrohydrochloricum Dilutum: HNO_3 4 parts,
 HCl 15 parts, H_2O 76 parts.

Acidum Sulphuricum Aromaticum: H_2SO_4 200 parts, Tr.
 20 per cent. absol. acid. ginger 45 parts, oil cinnam.
 1 part, alcohol 754 parts.

Acidum Sulphuricum Dilutum: H_2SO_4 and H_2O mixed.

10 per cent. absol. acid.

Acidum Phosphoricum Dilutum: H_3PO_4 and H_2O mixed.

10 per cent. absol. acid.

Table of Official Organic Drugs, with Natural Order, and their Constituents.

DRUG.	NAT. ORDER.	CONSTITUENTS.
Absinthium, Herba* (1).....	[Composit.]	Absinthin and Volatile Oil.
Acacia, Gummi (9).....	[Legumin.]	Arabin.
Aconitum, Tuber (4).....	[Ranunc.]	Aconitine, (and Starch).
Allium, Bulbus (1).....	[Liliac.]	Mucilage, Acrid Volatile Oil.
Aloe, Succus inspissatus (3).....	[Liliac.]	Alcin.
Amygdala amara, Semen (1).....	[Rosac.]	Fixed Oil, 45 % ; Amygdalin, 2 % ; Synaptase ; Sugar.
Amygdala dulcis, Semen (2).....	[Rosac.]	Fixed Oil, 50 % ; Synaptase ; Sugar.
Althæa, Radix (3).....	[Malvac.]	Mucilage, (Starch) and Asparagin.
Ammoniacum Gummi-resina (3).....	[Umbellif.]	 Volatile Oil ; Resin.
Anisum, Fructus (2).....	[Umbellif.]	 Volatile Oil.
<i>Anthemis, Flores*</i>	[Composit.]	Bitter Prin., Blue Volatile Oil, 1 % ; Resin.
<i>Apocynum, Radix</i>	[Apocyn.]	Apocynin (Resin), and Apocyneine.
Araroba (1).....	[Legumin.]	 Chrysarobin.
Arnica, Flores (1).....	[Composit.]	Arnicin and Resins, and Volatile Oil.
Arnica, Radix (3).....	[Composit.]	 Arnicin, Resins, Volatile Oil.
Asafetida, Gummi-resina (6).....	[Umbellif.]	 Volatile Oil and Resin.
<i>Asclepias, Radix</i>	[Asclepiadac.]	 Resin.

* The numbers indicate the number of preparations into which the drug enters. See pages 55-59. Italics indicates that the drug enters into no official preparation.

Aspidium, Rhizoma (1).....	[Filices.]	.....	Felice Acid, Oleoresin, Fixed Oil.
Aurantium, Fructus Cortex (2).....	[Aurant.]	.....	.....
“ “ amara (4).....	[Aurant.]	.....	.....
Aurantium, Flores (1).....	[Solanac.]	.....	.....
<i>Azedarach, Cortex</i> *.....	[Meliac.]	.....	.....
Belladonna, Folia (2).....	[Solanac.]	.....	.....
Belladonna, Radix (3).....	[Solanac.]	.....	.....
Benzoin, Resina Balsamica (3).....	[Styrac.]	.....	.....
Brayera, Flores (2).....	[Rosac.]	.....	.....
Bryonia, Radix recens (1).....	[Cucurbit.]	.....	.....
Buchu, Folia (1).....	[Rutac.]	.....	.....
Calamus, Rhizoma (2).....	[Arac.]	.....	.....
Calendulæ Herba (1).....	[Composit.]	.....	.....
Calumba, Radix (2).....	[Menisperm.]	.....	.....
Cambogia, Gummi-resina (1).....	[Guttifer.]	.....	.....
<i>Cannabis Americana</i>	[Urticac.]	.....	.....
Cannabis Indica, Summitates (3).....	[Urticac.]	.....	.....
Cantharis (6).....	[Insecta-Coleopt.]	.....	.....
Capsicum, Fructus (3).....	[Solanac.]	.....	.....
Cardamomum, Semen (8).....	[Zingiber.]	.....	.....
Carum, Fructus (1).....	[Umbellif.]	.....	.....
Caryophyllus, Flores (3).....	[Myrtac.]	.....	.....
<i>Cascarilla, Cortex</i>.....	{	.....	.....
Cassia Fistula, Fructus pulpa (1).....	Euphorb.]	.....	.....
Castanea, Folia (1).....	[Legumin.]	.....	.....
Catechu (2).....	[Cupulif.]	.....	.....
	[Legumin.]	.....	.....

* Italics indicates that the drug is not contained in any official preparation.

OFFICIAL ORGANIC DRUGS, WITH NATURAL ORDER, AND THEIR CONSTITUENTS.—*Continued.*

DRUG.	NAT. ORDER.	CONSTITUENTS.
<i>Caulophyllum, Rhizoma</i>	[Berberidac.]	Leotin, Saponin, Resins, etc.
<i>Cetraria</i> (1).....	[Lichenes.]	Lichenin, Cetrarin.
<i>Chelidonium, Herba</i>	[Papaver.]	Chelidonine, Chelerythrine.
<i>Chenopodium, Fructus</i>	[Chenopod.]	 Volatile Oil.
<i>Chimaphila, Folia</i> (1).....	[Ericac.]	Arbutin, Chimaphilin, Tannin 4 %.
<i>Chirata, Herba</i> (2).....	[Gentian.]	Ophelic Acid, Chiratin.
<i>Chondrus, Alga</i>	[Algæ.]	Pectin.
<i>Cimicifuga, Radix</i> (2).....	[Ranunculac.]	 Acrid principle.
<i>Cinchona, Cortex</i> (1), Rub. (1), Flav. (3). [Rubiac.]	{	{ Quinine, Quinidine, Cinchonine, Cinchonidine, Quinamine, Paricine, etc.; Cincho-tannic acid, Kinic Acid, Kinovin, Cinchona-red.
<i>Cinnamomum, Cortex</i> (9).....		 Volatile Oil, Cinnamic Acid.
<i>Coccus</i>	[Laurac.]	 Carnic Acid.
<i>Colchicum, Cormus</i> (3).....	[Insecta. Hemiptera.]	 Resin, Colchicine (Starch).
<i>Colchicum, Semen</i> (3).....	[Melanthac.]	 Colchicine (Fixed Oil).
<i>Colocynthis, Fructus Pulpa</i> (1).....	[Cucurbitac.]	 Pectin, Colocynthin.
<i>Conium, Fructus</i> (4).....	[Umbellif.]	Coniine, Conhydrine (Fixed Oil; Volatile Oil).
<i>Copaiba, Oleo-resina</i> (1).....	[Legumin.]	 Volatile Oil, Copaivic Acid (Resin).
<i>Coriandrum, Semen</i> (1).....	[Umbellif.]	 Muclage, Volatile Oil 1 % (Fixed Oil).
<i>Cornus, Radicis Cortex</i> (1).....	[Cornac.]	 Cornin, Resin, Tannin.
<i>Crocus, Stigmata</i> (1).....	[Iridac.]	 Crocin, Volatile Oil.
<i>Cubeba, Fructus</i> , (3).....	[Piperac.]	 Volatile Oil 12 %, Cubebic Acid (Resin), Cubebin.
<i>Cuprea, Cortex</i> (1).....	[Rubiac.]	 Quinine, Quinidine, Cinchonine, Homoquinine.
<i>Cydonium, Semen</i> (1).....	[Rosac.]	 Proteids, Muclage.
<i>Cypripedium, Radix</i> (1).....	[Orchid.]	 Volatile Oil, Resin.
<i>Digitalis, Folia</i> (5).....	[Scrophular.]	Digitoxin; Digitalin; Digitalin.
<i>Dulcamara, Stipites</i> (1).....	[Solanac.]	 Resin; Dulcamarin, etc.

Elaterium (1)	[Cucurbit.]	Hydroelaterin; Elaterin.
Ergota, Sclerotium (2).....	[Fungi.]	Sclerotic Acid; Scleromucin, etc.
Erythroxylon, Folia (1)	[Erythroxyli.]	Cocaine; Hygrine.
Eucalyptus, Folia (1)	[Myrtac.]	Tannin; Volatile Oil; Resin.
Euonymus, Cortex (1).....	[Calastrac.]	Bitter principle; Resin; (Asparagin).
Eupatorium perfoliatum, Herba (1).....	[Composit.]	Bitter principle; Volatile Oil.
Ficus, Fructus (1)	[Urticac.]	Sugar, 60 %; Gum, etc.
Feniculum, Semen (2), ...	[Umbellif.]	Fixed Oil; Sugar; Volatile Oil, 4 %.
Frangula, Cortex (1).....	[Rhannac.]	Frangulin (Rhamnoxanthin); Emodin.
Galbanum, Gummi-Resina (3)	[Umbellif.]	Volatile Oil; Resin.
Galla (2).....	[Cupulif.]	Resin; Tannin; Gallic Acid.
Gaultheria, Folia (1).....	[Ericac.]	Volatile Oil; Tannin; Ursone and Ericolin.
Gelsemium, Radix (2).....	[Loganiac.]	Gelsemine; Volatile Oil; Resin.
Gentiana, Radix (3).....	[Gentianac.]	Gentiopicroin; Gentisic Acid; (Pectin; Sugar).
Geranium, Radix (1).....	[Geraniac.]	Tannin, 15 %; (Starch; Pectin), etc.
Glycyrrhiza, Radix (11)	[Legumin.]	Glycyrrhizic Acid (Glycyrrhizin); Acrid Resin; (Starch; Asparagin; Albumen).
Gossypium, Radix (1).....	[Malvac.]	Fixed Oil; Resin (Coloring Matter), etc.
<i>Granati Radicis Cortex</i>	[Granatac.]	Punicine Pelletierine, Isopelletierine, Methyl-pelletierine, Pseudopelletierine; Tannin, (Gum; Sugar).
Grindelia, Herba (1)	[Composit.]	Resin; Volatile Oil; Bitter principle.
Guaiaci Lignum (2).....	[Zygophyll.]	 Resin, about 25 %.
Guarana (1)	[Sapindac.]	Caffeine, about 4 %; Tannin; Saponin; Volatile Oil.
Hæmatoxylon, Lignum (1).....	[Legumin.]	Hæmatoxylin; Tannin.
Hamamelis, Folia (1).....	[Hamamelac.]	Tannin; Bitter principle.
<i>Hedeoma, Herba</i>		Volatile Oil.
Humulus, Strobili (1).....	[Urticac.]	Tannin, 4 %; Volatile Oil; Resin; Lupuline.

OFFICIAL ORGANIC DRUGS, WITH NATURAL ORDER, AND THEIR CONSTITUENTS.—*Continued.*

DRUG.	NAT. ORDER.	CONSTITUENTS.
Hydrastis, Radix (2).....	[Ranuncul.]	Berberine; Hydrastine; Xantho-puccine.
Hyoscyamus, Folia (4).....	[Solanae.]	Hyoscyamine; Hyoscyne; Hyoscyperin.
Ignatia, Semen (2).....	[Loganiac.]	Strychnine; Brucine, (Albumen).
Illicium, Fructus.....	[Magnoliac.]	 Volatile Oil; Resin.
Inula, Radix.....	[Composit.]	Acrid Resin; Helenin; Inulin.
Ipecacuanha (4).....	[Rubiace.]	{ Emetine (Ipecacuanhic Acid); Starch; Pectin; trace of Volatile Oil.
Iris versicolor, Rhizoma (2).....	[Iridac.]	Acrid Resin; Volatile Oil (Starch).
Jalapa, Tuber (3).....	[Convolvul.]	Resin, about 15 % (chiefly convolvulin); (Starch), etc.
Juglans, Cortex (1).....	[Juglandac.]	Fixed Oil; Tannin; Nucin.
Juniperus, Fructus.....	[Conif.]	 Volatile Oil; Resin; Sugar 30 %.
Kamela, Glandulae.....	[Euphorb.]	Resin 80 %; (Rottlerin), etc.
Kino, Succus inspissatus (1).....	[Legumin.]	Kino-tannic Acid; (Coloring Matter); (Kinoin); Pectin.
Krameria, Radix (3).....	[Polygalac.]	Kramerio-tannic Acid; (Coloring Matter).
Lactucarium (1).....	[Composit.]	{ Lactucin; Lactucic Acid; Lactucopicrin; (Lactucerin 50 %).
Lappae Radix.....	[Composit.]	Mucilage; Resin; Inulin.
Lavandula, Flores (1).....	[Labiata.]	Resin; Volatile Oil $2\frac{1}{2}$ %.
Leptandra, Radix (2).....	[Scrophular.]	{ Leptandrin; Saponin; Volatile alkaloid?; Volatile Oil; Resin.
Limonis Cortex (2).....	[Aurantiac.]	 Volatile Oil; Hesperidin?.
Limonis Succus (2).....	[Aurantiac.]	Citric Acid; water, etc.
Linum, Semen.....		Fixed Oil; Mucilage.
Lobeliae Herba (3).....	[Lobeliac.]	Lobeline; Lobelacrin; Lobelic Acid.

Lupulinum (2)	[Urticac.].....	Volatile Oil ; Resin ; Lupamaric Acid.
Lycopodium.....	[Lycopod.].....	Fixed Oil, about 47 %.
<i>Macis, Arillus</i>	[Myristic.].....	Volatile Oil, 9 % ; (Fixed Oil).
<i>Magnolia, Cortex</i>	[Magnoliac.]	Magnolin ; Volatile Oil ; Resin ; Tannin.
Manna (1).....	[Oleac.].....	Mannit ; Glucose ; Gum ; Acrid Resin ; Fraxin.
<i>Marrubium, Herba</i>	[Labiât.].....	Marubin ; Bitter extractive.
Mastiche [1]	[Terebinth.].....	Resin and Volatile Oil.
Matico, Folia (2)	[Piperac.].....	{ Volatile Oil ; Soft, pungent Resin ; Artanthic Acid ; Tannin.
<i>Matricaria, Herba</i>	[Composit.].....	Volatile Oil ; Bitter principle ; Tannin.
Mel (1)	[Insecta. Hymenopt.].....	Melitose ; Lævulose ; Glucose.
<i>Melissa, Herba</i>	[Labiât.].....	Volatile Oil ; Bitter Extractive.
<i>Menispermum, Radix</i>	[Menispermac.]	Menispermine ; Berberine.
Mentha Piperita Herba (2).....	[Labiât.].....	Volatile Oil 1 %.
Mentha Viridis, Herba (1)	[Labiât.].....	Volatile Oil 0.5 %.
Mezereum Cortex (4)	[Thymelac.].....	Acrid Resin ; Volatile Oil ; Daphnin.
Moschus (1).....	[Mamm. Ruminant.].....	Cholesterin ; Bitter Resin ; Fat.
Myristica, Semen (7)	[Myristicac.].....	Volatile Oil ; Fixed Oil ; (Starch.)
Myrrha, Gummi-Resina (7).....	[Burserac.].....	Bitter principle ; Volatile Oil ; Resin.
Nux Vomica, Semen (4)	[Loganiac.].....	Strychnine ; Brucine ; (Fixed Oil ; Albumen.)
Opium (2)	[Papaverac.] ...	{ Morphine, Codeine, Narcotine, Narceine, Pseudomor- phine, Thebaine, Papaverine, Meconic Acid, etc.
Origanum, Herba (1).....	[Labiât.].....	Tannin Resin ; Volatile Oil.
Pareira, Radix (1).....	[Menispermac.].....	Buxine ; Resin.
<i>Pepo, Semen</i>	[Cucurbit.].....	Proteids, Fixed Oil.
Physostigma, Semen (2).....	[Legumin.].....	Physostigmine ; Calabarine ; (Starch ; Albumen).
<i>Phytolacæ Bacca</i>	[Phytolacac.].....	Acrid principle.

OFFICIAL ORGANIC DRUGS, WITH NATURAL ORDER, AND THEIR CONSTITUENTS. — *Continued.*

DRUG.	NAT. ORDER.	CONSTITUENTS.
<i>Phytolacæ Radix</i>	[Phytolaccac.]	Resin Tannin, Acid principle.
<i>Pilocarpus, Folia</i> (1).....	[Rutac.]	Pilocarpine; Volatile Oil.
<i>Pimenta, Fructus</i>.....	.....	.....Volatile Oil; Resin.
<i>Piper, Fructus</i> (1).....	[Piperac.]	Volatile Oil; Acid Resin; Piperin.
<i>Podophyllum, Radix</i> (4).....	[Berberidac.]	{ Resin, containing Podophyllotoxin and Picropo-
.....	.....	phyllin. (Starch).
<i>Prinos, Cortex</i>	[Aguifoliac.]	Resin; Bitter principle; Tannin.
<i>Prunus Virginiana, Cortex</i> (3).....	[Rosac.]	{ Tannin; Amygdalin; Synaptase; Bitter principle,
.....	.....	etc. Yields HCl when moistened.
<i>Prunum Fructus</i> (1).....	[Rosac.]	Pectin Sugar; Malic Acid.
<i>Pulsatilla, Herba</i>	[Ranuncul.]	Acrid principle, Volatile.
<i>Pyrethrum, Radix</i> (1).....	[Composit.]	Volatile Oil; Acid Resin.
<i>Quassia, Lignum</i> (3).....	[Simarubac.]	Mucilage, Resin, Quassin.
<i>Quercus, Cortex</i>	[Cupulif.]	Tannin; Bitter principle.
<i>Quillaia, Cortex</i>	[Rosac.]	Saponin; Resin.
<i>Resina (Colophonium)</i> (5).....	[Conif.]	Abietic anhydrid.
<i>Rheum, Radix</i> (9).....	[Polygonac.]	{ Chrysophan; Chrysophanic Acid; Phæoretin;
.....	.....	Aporetin; Erythrorutin; Emodin; Rheo-tannic
.....	.....	Acid (Starch).
<i>Rhus glabra, Fructus</i> (1).....	[Terebinthac.]	Acid Pot. and Ca., Malates Tannin.
<i>Rhus Toxicodendron, Folia</i>	[Terebinthac.]	Toxicodendric Acid. (Tannin).
<i>Rosa Gallica, Petala</i> (4).....	[Rosac.]	Quercitrin; Tannin? Volatile Oil. (Coloring matter).
<i>Rosa centifolia, and damascena Petala</i> (2).....	[Rosac.]	Tannin; Volatile Oil.
<i>Rosmarinus, Folia</i> (1).....	[Labiât.]	Volatile Oil; Tannin; Resin; Bitter principle.
<i>Rubus, Radicis Cortex</i> (1).....	[Rosac.]	Tannin, 10%.

Rumex crispus, Radix (1).....	[Polygonac.].....	As Rhubarb, but more astringent.
Sabina, Ramuli (1).....	[Conif.].....	Volatile Oil (Resin; Tannin).
Salix, Cortex.....	[Salicac.].....	Salicin; Populin (Benzoyl-Salicin); Tannin.
Salvia, Folia (1).....	[Labi.].....	Resin, Volatile Oil; Tannin.
Sambucus, Flores.....	[Caprifol.].....	Mucilage, Volatile Oil; Acrid Resin.
Sanguinaria, Radix (3).....	[Papaverac.].....	Resin, Starch, Sanguinarine.
Santalum rubrum, Lignum (1).....	[Legumin.].....	Santal, Santalic Acid.
Santonica, Flores.....	[Compos.].....	Santonin; Volatile Oil; Resin.
Sarsaparilla, Radix (4).....	[Smilac.].....	Smilacin (Parillin); Saponin; Resin (Starch; Gum).
Sassafras, Cortex (3).....	[Laurac.].....	Starch; Volatile Oil.
Sassafras, Medulla (1).....	[Laurac.].....	Mucilage.
Scammonium, Resina cruda (1).....	[Convolvul.].....	Scammonin (Pararhodeotin, or Jalapin).
Scilla, Bulbus (4).....	[Liliac.].....	Scillipicrin; Scillitoxin; Scillin; Gum.
Scoparius, Summitates.....	[Legumin.].....	Sparteine, Scoparin.
Scutellaria, Herba (1).....	[Labi.].....	Bitter principle; Volatile Oil.
Senega, Radix (3).....	[Polygalac.].....	Senegin (Saponin ?); (Fixed Oil. Pectin ?).
Senna, Folia (6).....	[Legumin.].....	Cathartic Acid; Chrysophanic Acid ? etc.
Serpentaria, Radix (3).....	[Aristoloch.].....	Volatile Oil; Resin; Bitter principle (aristolochin).
Sinapis alba, Semen.....	[Crucif.].....	{ Myrosin and Sinalbin, giving rise to Acrid Volatile Oil. Fixed Oil.
Sinapis nigra, Semen (1).....	[Crucif.].....	{ Nigrosin and Sinigrin, giving rise to Acrid Volatile Oil. Fixed Oil.
Spigelia, Radix (1).....	[Loganiac.].....	 Volatile Oil; Bitter principle; Spigeline ?.
Staphisagria, Semen.....	[Ranuncul.].....	{ Delphinine; Delphinoidine; Delphinine; Staphisagrine. Fixed Oil.
Stillingia, Radix (1).....	[Euphorbiac.].....	 Resin. (Starch, Tannin.)
Stramonium, Folia.....	[Solanaec.].....	{ Atropine and Hyoscyamine (together constituting what was formerly called <i>daturine</i>); (Albumen).
Stramonium, Semen (3).....	[Solanaec.].....	{ Atropine and Hyoscyamine (see Stramonii Folia) (Fixed Oil).

OFFICIAL ORGANIC DRUGS, WITH NATURAL ORDER, AND THEIR CONSTITUENTS.—*Continued.*

DRUG.	NAT. ORDER.	CONSTITUENTS
Styrax, Balsamum (1).....	[Hamamel.]	Styrac ; Cinnamic Acid ; Styrcin ; Resin, etc.
Sumbul, Radix (1).....	[Umbellif.]	Volatile Oil ; Resin ; Angelic and Valerianic Acids.
<i>Tabacum, Folia</i>	[Solanac.]	Nicotine, 2 to 10 % ; Nicotianin ; Resin (Albumen).
Tamarindus, Fructus Pulpa (1).....	[Legumin.]	Fruit Acids ; Sugar ; Pectin.
<i>Tanacetum, Flores</i>	[Compos.]	Resin ; Volatile Oil 0.25 % ; Tanacetin.
Taraxacum, Radix (2).....	[Compos.]	Taraxacin ; Taraxacerin ; Inulin.
<i>Terebinthina</i> (Pinis Oleoresina)	[Conifer.]	Volatile Oil ; Resin.
Terebinthina Canadensis, Oleoresina.....	[Conifere.]	Volatile Oil ; Resin.
<i>Thuja, Ramuli</i>	[Conifer.]	Volatile Oil ; Resin.
Tolubalsamum (2).....	[Legumin.]	Cinnamic and Benzoic Acids, and Toluene.
Tragacantha, Gummi (9).....	[Legumin.]	Tragacanth ; Bassorin.
Triticum repens, Rhizoma (1).....	[Gramin.]	Sugars ; Triticin.
Ulmus, Cortex (1).....	[Urticac.]	Mucilage.
<i>Ustilago</i>	[Fungi.]	Sclerotic Acid ? (Fixed Oil), etc.
Uva Ursi, Folia (1).....	[Ericaceæ.]	Gallic Acid ; Arbutin ; Ursin ; Ericolin ; Tannin.
Valeriana, Radix (4).....	[Valerianac.]	Volatile Oil ; Valerianic Acid.
Vanilla, Fructus (2).....	[Orchid.]	Vanillin (Fixed Oil ; Resin ; Gum).
Veratrum viride, Rhizoma (2).....	[Melanthac.]	{ Jervine ; Pseudojervine ; Rubijervine ; Veratralbine.
Viburnum prunifolium, Cortex (1).....	[Caprifoliac.]	{ Jervic Acid. Veratramarin.
<i>Viola tricolor, Herba</i>	[Violac.]	Viburnin ; Valerianic Acid ; Resin ; Tannin.
.....	.....	.....Violin ? ; Salicylic Acid ? (Coloring Matter), etc.
Xanthoxylum, Cortex (1).....	[Rutac.]	Acrid Oleoresin ; Xanthoxylin ; Berberine.
Zingiber, Radix (6)	[Zingiberac.]	Volatile Oil ; Pungent Resin (Starch).

Organic Compounds.

What are organic compounds?

Any compound containing carbon is an organic compound, whether it be a constituent of the animal or vegetable body or not. Practically all carbon compounds are organic compounds, and all the so-called organic compounds are carbon compounds.

How may the organic compounds be classified for pharmaceutical study?

They may be classified as Hydrocarbons, Carbohydrates, etc., as follows:—

NATURAL HYDROCARBONS: Benzin, Petrolatum.

DERIVATIVES OF THE PARAFFIN SERIES OF HYDROCARBONS, C_nH_{2n+2} .

Derivatives of Methane, CH_4 : Chloroform, Iodoform.

Derivatives of Ethane, C_2H_6 : Alcohol, Ether, Acetic Ether, Nitrous Ether, Tartaric Acid, Chloral, Oxalic Acid.

Derivatives of Propane, C_3H_8 : Glycerin, Lactic Acid, Citric Acid.

Derivatives of Pentane, C_5H_{12} : Nitrite of Amyl, Valerianic Acid.

Acids of Acrylic Acid Series, $C_nH_{2n-2}O_2$: Oleic Acid.

Benzene Series, C_nH_{2n-6} : Phenol, Benzoic Acid, Salicylic Acid, Gallic Acid, Tannic Acid, Thymol, Benzol, Camphor.

NATURAL HYDROCARBONS.

What natural product is composed mainly of saturated hydrocarbons?

Petroleum, composed of various substances having different boiling points, from the lowest, which is gaseous at ordinary

temperatures, to the sixteenth in the series, which boils only at about 280°C .; Rhigolene being one of the lighter and more volatile, and Paraffin one of the heavier and least fusible.

What is benzin of the U. S. P.?

Benzinum (pentane C_5H_{12} , hexane C_6H_{14}). It is a purified distillate from Petroleum, known also as Petroleum spirit. A very volatile liquid; boiling point 50° to 60°C . (122° to 140°F .). Sp. gr. from 0.670 to 0.675. (Benzene or Benzol is quite a different fluid. See *Index*.)

What is petrolatum?

It is a soft, unctuous substance, recognized as an ointment of paraffin, known in commerce under various fanciful names; is really a semi-solid of paraffin, usually obtained by purifying the less volatile portions of petroleum.

DERIVATIVES OF THE PARAFFIN SERIES OF HYDROCARBONS, $\text{C}_n\text{H}_{2n+2}$.

DERIVATIVES OF METHANE, CH_4 .

(200) CHLOROFORM (boils at 60° – 61°C .; sp. gr. 1.485–1.490), CHCl_3 (Methane with three Cl's substituted for three H's).

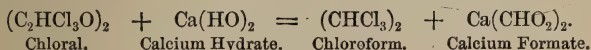
Name two varieties of chloroform.

(Purified and commercial chloroform (Chlor. Purificatum and Chlor. Venale). The former alone should be dispensed to be used anæsthetically.

How is chloroform made?

It is made by acting upon alcohol by means of chlorinated lime, which, yielding chlorine, produces, in the first step of the process, aldehyde ($\text{C}_2\text{H}_4\text{O}$), and chloral ($\text{C}_2\text{HCl}_3\text{O}$) in the

second step. The chloral thus produced is acted upon by calcium hydrate, according to the following equation:—



How is commercial chloroform purified?

By treating with H_2SO_4 , which destroys (blackens) the organic impurities, the chloroform separating into a distinct layer; the chloroformic layer is removed, neutralized by Na_2CO_3 , mixed with alcohol (a preservative), and redistilled from lime to separate water.

What are the officinal preparations of chloroform?

See Preparations.

(Insol.?) IODOFORM, CHI_3 (Methane with three I's substituted for three H's).

How is iodoform made, and what are its physical properties?

It is formed by the action of KOH or NaOH in water on alcohol, with iodine. It is a crystalline solid, of yellow color and saffron-like odor; it contains 96.7 per cent. of iodine.

Off. Prep. Unguentum.

What is methylic alcohol? Give its properties, and the names under which it is known in market.

It is the hydrate of methyl, CH_3OH , obtained by the destructive distillation of wood; it is known as *wood spirits*, *pyroxylic spirit* or *wood naphtha*. It is a solvent similar to alcohol; poisonous, inflammable, disagreeable odor; used in making varnishes, etc.

What is methylated spirits?

A mixture of 90 per cent. of ethylic alcohol with methyl alcohol.

DERIVATIVES OF ETHANE, C_2H_6 .

ALCOHOL (boils at 78°C .; sp. gr. .820), $\text{C}_2\text{H}_5\text{OH}$ (Ethane with OH substituted for H).

How is ethylic alcohol obtained, and by what other name is it known?

Obtained by distillation of fermented glucose (the latter obtained from starch), by the following reaction:—



Fermentation. (See *Index*.)

From what substances is the starch usually obtained for making alcohol?

Corn, rye, potatoes, etc.

How are these substances converted into glucose?

They are *mashed*; and on the addition of malt, by the influence of its *diastase*, at a proper temperature, the starch is converted first into *maltose*, then into *glucose*.

Name the various crude alcohols and give their source.

Whiskey, from corn, etc., above mentioned; *Brandy*, distilled from wine; *Rum*, distilled from fermented molasses; *Gin*, spirit distilled with juniper berries.

What aromatic substances are contained in these crude alcohols?

Whiskey contains amylic alcohol (fusel oil), ænanthic ether, etc.; Brandy, ænanthic, propylic ethers, etc.; Rum, butyric acid, etc.

How may alcohol be purified or deodorized?

By the use of animal charcoal, which absorbs most of the fusel oil; sometimes distilled with certain chemicals which destroy these foreign odors.

What is absolute alcohol?

Alcohol freed from water by treatment with lime, chloride of calcium, or some salt having a great affinity for water.

Off. Prep. Alcohol. Dilutum (sp. gr. .928; Al. 50, Aq. Dest. 50). A liquid composed of 45.5 per cent. by weight

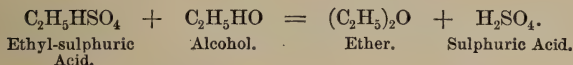
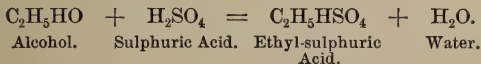
(53 per cent. by vol.) of ethyl alcohol, and 54.5 per cent. by weight (47 per cent. by vol.) of water.

ETHER (Fort. boils at 37° ; sp. gr. .725), $(C_2H_5)_2O$ (two Ethanes with O substituted for H in each).

How is stronger ether made?

A mixture of H_2SO_4 and alcohol is maintained at a temperature of 130° – 137.7° C. in a retort, into which flows a slow but constant stream of alcohol; the distillate (composed of crude ether, acid, alcohol, etc.) is shaken with milk of lime and water. Upon standing, the ether (purified from H_2SO_4 and alcohol) rises to the surface. The decanted ether, treated with calcium chloride (to remove water) and redistilled, constitutes the *æther fortior*, U. S. P.

Explain the above reaction.



What is the danger in handling ether?

Unlike chloroform, it is very inflammable; danger is, therefore, to be apprehended from fire. The container should always be held at a distance from any flame.

What preparations of ether are officinal? and state the percentage of their constituents.

Spiritus Ætheris (Strong. Ether 30, Alcohol 70); Spiritus Ætheris Compositus (Hoffmann's Anodyne), (Strong. Ether 30, Alcohol 67, Ethereal Oil 3).

What is a compound ether?

A substance resembling a chemical salt, the difference being

that the hydrogen of the acid is not replaced by a *metal*, but by an *organic radical*, as in the following compounds:—

What is ethereal oil?

Ethereal Oil (heavy oil of wine) is produced when alcohol is treated with H_2SO_4 at a temperature between 150° – 157° C. The purified product is mixed with an equal volume of stronger ether, which constitutes the *Oleum Ætherium* of the U. S. P. (It is a salt of Ethyl, Sulphuric and Sulphurous acids, used in Sp. ether, comp.)

ACETIC ETHER [boils at 76° C.; sp. gr. 889–897] $\text{CH}_3\text{-COOC}_2\text{H}_5$ (Ethane with acetic acid radical substituted for H) *Compound Ether*.

What is the officinal and chemical name of acetic ether?

Æther Aceticus, Acetate of Ethyl. ($\text{C}_2\text{H}_5\text{C}_2\text{H}_3\text{O}_2$).

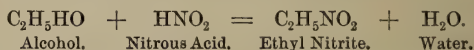
How is acetic ether made?

By decomposing acetate of sodium by means of H_2SO_4 in the presence of alcohol.

NITROUS ETHER [Boils at 63° C.; sp. gr. 823–825] $\text{C}_2\text{H}_5\text{-NO}_2$ (Ethane with nitrous acid radical substituted for H).

How is nitrous ether made?

By decomposing alcohol by means of HNO_3 . Aldehyd is first formed, liberating nitrous acid, which, in turn, acts upon alcohol according to the following equation:—



What is sweet spirits of nitre (spiritus ætheris nitrosi)?

It is an alcoholic solution of nitrite of ethyl, containing five per cent. of this ether [sp. gr. 823–825; boils at 63° C.].

TARTARIC ACID $(\text{CHOHCOOH})_2$ (Ethane with 2OH substituted for 2H and 2COOH for 2H) Acidum Tartaricum Dihydroxy succinic acid.

What is the source of tartaric acid?

Formed in grapes, tamarinds and other fruits, and prepared commercially from *argols*, or impure acid potassium tartrate, deposited from grape juice during fermentation into wine.

How is it made from argols?

By first purifying the argols (see Pot. Tartrate) and converting the cream of tartar into a calcium salt by means of CaCO_3 and CaCl , decomposing the resulting Ca. tartrate with diluted H_2SO_4 and allowing the filtered solution to crystallize in a warm place.

ACETIC ACID, CH_3COOH (Ethane with O substituted for 2H and OH for another H). Composed of 36 per cent. of absol. acid.

How is acetic acid made?

Acetic acid is made by distilling *vinegar*, which is made by oxidation of dilute alcoholic liquids, such as cider and wine. It is also made very largely by subjecting oak wood in small billets to the process of dry distillation, the heat being so regulated as not to char the fiber and produce empyreumatic products.

How is the strongest acid designated, and what are its properties?

Glacial acetic acid (Acidum Aceticum Glaciale). At or below 15°C . a crystalline solid. It is a colorless, pungent liquid, attracting moisture from the air. Should be kept in well-stoppered bottles.

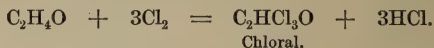
Off. Prep. Acidum Aceticum Dilutum.

CHLORAL, $\text{CCl}_3\text{C}(\text{OH})_2\text{H}$ (Ethane, with 3Cl substituted for 3H, and 2OH for 2H).

What is the officinal synonym of chloral, and how is it made?

Hydrate of Chloral is made by passing dry chlorine gas through absolute alcohol until no more is absorbed. The

alcohol is thus converted into aldehyd and HCl, and, finally, the aldehyd into chloral, according to the following equation:—



The chloral is hydrated by mixing it with the necessary amount of water; then, purified and crystallized, it constitutes the officinal product of the following composition:—



OXALIC ACID, $(\text{COOH})_2$ (Ethane with 2O substituted for 4H, and 2OH for 2H).

In what preparations of the pharmacopœia is this found?

Volumetric solution of oxalic acid.

What salts of oxalic acid are officinal?

Ammonii Oxalas (in test solution), Ferri Oxalas, Cerii Oxalas.

How is oxalic acid made?

It is made by acting upon sugar, starch, cellulin with HNO_3 , by the aid of heat. It is made on a large scale by heating sawdust with caustic soda, etc.

What is salts of lemon, and why should it be handled with care?

Salts of lemon is the common name for oxalate of potassium, used as a bleaching agent and for removing iron stains. Its name and appearance (like Epsom salts) at once show why it should be handled carefully, as a poison.

DERIVATIVES OF PROPANE, C_3H_8 .

GLYCERINE, $\text{C}_3\text{H}_5(\text{OH})_3$ (Propane with 3OH substituted for 3H).

From what is glycerine obtained?

It is obtained from fats as a by-product of saponification,

and by the decomposition of fats and oil with pressure and superheated steam. (See Oleic Acid.)

What officinal preparations contain glycerine?

Glyceritum Amyli., Gly. Vitelli., Mucil. Tragacanth., Fl. Exts. and Exts.

LACTIC ACID (sp. gr. 1.212), $C_2H_4OH(COOH)$ (Oxypropionic acid).

How is lactic acid made?

It is made from sour milk, cheese, and other animal substances, but preferably by treating cane sugar with H_2SO_4 , so as to convert it into invert sugar. Solution of caustic soda is then added, and heated until the absence of sugar is shown by Fehling's solution. The lactic acid formed is freed from soda by the addition of H_2SO_4 , the two latter crystallizing out as sulphate of sodium, aided by the addition of alcohol. Lactate of zinc is now formed by the addition of Zn Carb. to the crude acid; the zinc salt is finally decomposed by H_2SO_4 .

Off. Prep. Syr. Calcii Lactophosphatis.

CITRIC ACID, $C_3H_4OH(COOH)_3$. (Propane with OH substituted for H and $3COOH$ for $3H$.)

What is the source of citric acid?

It occurs in the juice of lemons, gooseberries, currants, etc.

How is it obtained?

By allowing the juice to undergo an incipient fermentation, filtering and neutralizing by means of powdered chalk and milk of lime, the insoluble calcium citrate is precipitated and then decomposed by H_2SO_4 .

Into what does citric acid decompose when fused with KHO?

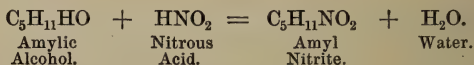
Into oxalic and acetic acids. (Has been synthetically formed from glycerine, etc.)

DERIVATIVES OF PENTANE, C_5H_{12} .

NITRITE OF AMYL (Boils at 96° C. sp. gr. 872-874) $C_5H_{11}NO_2$. (Pentane with NO_2 substituted for H.)

How is this compound ether made?

It is made by acting upon amylic alcohol by means of HNO_2 thus:—

**Describe the medical and physical properties of amyl nitris.**

It is a yellow liquid, having a suffocating odor, flushing the face by paralyzing the peripheral capillaries, and thereby relieving cardiac tension. It is used in angina pectoris; also, in asthma, 5-6 drops being inhaled from a handkerchief. It is dispensed in glass capsules (pearls).

What other important compound ethers are extensively used?

Artificial fruit essences, used as fruit flavors in syrups, confections, etc.

What ethereal salt is oil of winter-green?

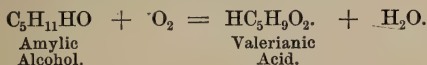
Methyl salicylate. The artificial product is scarcely distinguished from the natural.

VALERIANIC ACID (Valeric or Pentylic Acid), $(CH_3)_2CH-CH_2COOH$. (Pentane with O substituted for 2H and OH for H).

What is the natural and artificial source of valerianic acid?

It is obtained naturally from valerian root associated with the volatile oil, from which it is derived, but it is prepared artificially from amylic alcohol (fusel oil), H_2SO_4 , and bichro-

mate of potassium. The two latter substances furnishing oxygen and acting upon the alcohol, thus:—



Off. Prep. Ammonii Valerianas $\text{NH}_4\text{C}_5\text{H}_9\text{O}_2$.

Made by passing ammonia gas into mono-hydrated valerianic acid.

What chemical resemblance is there between valerianic and acetic acids?

Valerianic acid bears the same relation to amylic alcohol that acetic acid bears to ethylic alcohol, thus:—



(Compare with above equation.)

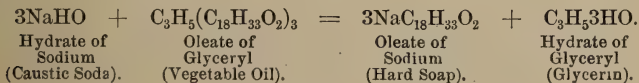
ACIDS OF ACRYLIC ACID SERIES, $\text{C}_n\text{H}_{2n-2}\text{O}_2$.

OLEIC ACID ($\text{C}_{18}\text{H}_{34}\text{O}_2$).

What is oleic acid?

Acidum Oleicum.

It occurs as a glyceride in fats; a yellowish, oily liquid, gradually becoming brown, rancid, and acid when exposed to the air; neutral reaction, but unites with alkalies, forming salts (soaps). It is associated with *stearic* and *palmitic* acids in fats; if, therefore, an alkali or a basic substance be added to an oil or fat an *oleate*, *stearate* and *palmitate* of a base are formed, while the glycerin (the organic base with which the fatty acids were combined) is liberated. To make this plain we will use a *vegetable oil*, containing wholly oleate of glyceryl, and decompose it as follows:—



Oleic acid can be obtained by decomposition of various soaps and purification of the cruder products. Crude Oleic Acid is known commercially as "Red Oil," obtained from soap works.

BENZENE SERIES, C_nH_{2n-6} .

BENZENE, C_6H_6 .

Give a brief account of this interesting organic substance.

It is obtained from coal tar. The fraction boiling below $150^\circ C.$, is freed from phenols by shaking with $NaHO$, Aq., and from bases by shaking with H_2SO_4 . It is then rectified. It is a colorless, scarcely soluble, liquid. Dissolves S, P, I, fats, resins, oils, and many alkaloids. It is converted by fuming HNO_3 into nitro-benzene (nitro-benzol—artificial oil of bitter almond—also called oil of mirbane).

When this nitro-benzol is washed with water it is reduced by tin and HCl to *aniline*.

NOTE.—This substance must not be confounded with *benzinum*, petroleum ether of the Pharmacopœia (*q. v.*).

(20.) PHENOL, C_6H_5OH (Fuses at 36° – $42^\circ C.$ Boils at 181° – $186^\circ C.$) (Benzene with OH substituted for H).

How is carbolic acid (phenol) obtained, and what are some of its properties?

It is a product of the distillation of coal tar between the temperatures of 180° and $190^\circ C.$ Deliquescent, slightly aromatic (resembling creasote), needle-shaped crystals; colorless, becoming pinkish on exposure, having (diluted) a sweetish taste (undiluted), a peculiar caustic effect upon the skin. Deliquescent on exposure, and remains permanently liquid on the addition of 5 per cent. of water. (See also Creasote.)

What is creasote?

A mixture of substances, of phenolic character, which may be extracted by alkalies from tar obtained by dry distillation

of wood. Beech tar creasote contains phenol, guaiacol, cresols, etc.

Off. Prep. Aqua Creasoti.

How may creasote and carbolic acid be distinguished?

Creasote does not (carb. acid does) coagulate albumin or collodion. If one volume of creasote be mixed with one volume of glycerine a nearly clear mixture results, from which the creasote may be separated by one or more volumes of water. Carbolic acid under like conditions is dissolved, forming a transparent solution. On adding to ten c.c. of a 1 per cent. aqueous solution, one drop of test solution of ferric chloride the liquid acquires a violet-blue tint, rapidly changing to greenish and brown, with formation usually of a brown ppt. (creasote),—the liquid acquires a violet-blue color, which is permanent (carbolic acid).

Carbolic acid is associated with what officinal salt?

Sulphocarbolate of sodium. Carbolic acid is soluble in H_2SO_4 , furnishing sulphocarbolic acid, phenolsulphonic acid, or sulphophenic acid, which unites with bases to form salts.

Off. Prep. of Carbolic Acid. Unguentum.

(500) BENZOIC ACID, $\text{C}_6\text{H}_5\text{COOH}$ (Benzene with COOH substituted for H).

What is the source of benzoic acid?

Various resins, *e. g.*, gum benzoin, dragon's blood, and balsams—storax, Peru, and tolu. In the higher boiling phenolic portion of coal-tar, etc.

How is it made, and give its physical properties?

It is best made from varieties of benzoin containing no cinnamic acid, by sublimation. It is also obtained from hippuric acid, urine of horses or oxen. Milk of lime is added to the putrefied urine; excess of lime is ppt. by CO_2 and the filtrate ppt. by Fe_2Cl_6 ; the ferric benzoate is decomposed by

HCl. Crystallizes in needles or pearly plates, which are generally aromatic. Inodorous when pure,

(450) SALICYLIC ACID, $C_6H_4OHCOOH$ (Benzoic acid with OH substituted for H). Hydroxybenzoic acid.

How does this acid exist in nature, and how is it prepared?

It exists as methyl salicylate in oil of wintergreen, from which it may be obtained. It is, however, made artificially on a large scale by the combined action of sodium and carbonic anhydride upon phenol

The following equation illustrates the process:—



What are some of the properties of salicylic acid?

White, light (floating on water), crystalline substance; when rapidly heated, is converted into phenol and carbon dioxide. The aqueous solution is colored intensely violet-red by test solution of ferric chloride. It unites with alkalis, forming soluble salts, salicylate of sodium being officinal. (See Sodium.)

(100) GALLIC ACID, $C_6H_2(OH)_3COOH$ (Benzoic Acid with 3OH substituted for 3H). Trihydroxybenzoic Acid.

How is gallic acid obtained?

Moistened nutgalls are exposed to the air for a month or more, to allow a peculiar fermentation to set in; the tannic acid of the galls is thus converted into gallic acid, which is then extracted by subjecting the pasty mass to pressure, and purified by solution, filtration through purified animal charcoal, and crystallization.

What effect has heat upon gallic acid?

When heated at $210^\circ C.$, it forms pyrogallie acid and carbon dioxide.

How can it be distinguished from tannic acid?

By its sparing solubility in cold water and by not precipitating gelatin or alkaloids from their solution, and by its crystalline form, which is acicular.

Off. Prep. Ung. Acidi Gallici.

(6) TANNIC ACID, $C_{14}H_{10}O_9$ (Anhydride of Digallic Acid).

What are the sources of tannin or tannic acid?

The officinal tannic acid is obtained from nutgalls, but tannins exist also in oak bark, cinchona, catechu, coffee, krameria, salix, kino, rhus glabra, salvia, etc. They are astringent, amorphous bodies; they precipitate albumin, alkaloids, ferric salts (differently colored, inky precipitates) and gelatin. Tannic acid also precipitates tartar emetic.

How is tannin made?

Powdered nutgalls is exposed to a damp atmosphere for two or three days. It is then made into a soft paste, by mixing with ether, and macerated for twenty-four hours. By strong pressure the liquid portion is separated; the compressed cake is then mixed with sufficient ether and water (16 of the former to 1 of the latter) to form a soft paste, and expressed as before; the expressed liquids are then evaporated at a temperature not exceeding $100^{\circ}C$.

Off. Prep. Collod. Stypt.; Tro. Acidi Tannici; Ung. Acidi Tannici.

(1200) THYMOL (sp. gr. 1.028; melts at $50^{\circ}C$.), $C_{10}H_{14}O$ (Cymene, $C_{10}H_{14}$, with OH substituted for H).

What is the source and properties of thymol?

Thymol crystallizes out when oil of thyme is kept at a low temperature for a day or two. It may also be obtained by shaking the oil with caustic alkali, treating the alkaline liquid with an acid, and crystallizing from alcoholic solution. It is the stearepten of oil of thyme; has antiseptic properties.

What is a stearopten?

Volatile oils are usually mixtures of the liquid hydrocarbons, or *elæoptens*, with oxidized hydrocarbons, which are commonly solid or camphor-like bodies, termed *stearoptens*.

CAMPHOR, $C_{10}H_{16}O$ (sp. gr. .990-.995; melts at $175^{\circ} C.$).

What is camphor?

A stearopten derived from *cinnamomum camphora*, and purified by sublimation (U. S. P.).

Off. Prep. Aq.; Liniment.; Liniment. Saponis; Spts.; Tr. Opii Camph.

What unofficinal stearopten has a prominent place among the remedial agents, and how is it related to the other stearoptens?

Menthol, bearing the same relation to oil of mint as that of thymol to oil of thyme; its composition is $C_{10}H_{18}H_2O$.

RESEARCH QUESTIONS ON SOME OF THE ABOVE
ORGANIC COMPOUNDS.

How may the sweet spirits of nitre be quantitatively examined?

How may the alcoholic strengths of brandy, whisky, wine, etc., be determined?

How can brandy and whisky be examined for fusel oil, undue amounts of solids, glycerine, etc.?

What are the tests for lead, copper, iron, H_2SO_4 , in tartaric acid?

What is the test for tartaric and oxalic acids in citric acid; also, Pb, Cu, Fe, SO_4 , in the same?

Absence of acids (and HCl) and presence of alcoholate, in chloral?

THE TERPENE SERIES OF HYDROCARBONS.



TEREBINTHINA, oil of turpentine, $C_{10}H_{16}$ (sp. gr. 855–870).

What is the source and properties of oil of turpentine?

It is obtained by the distillation of the oleoresin (gum) turpentine, which flows naturally (or by incision) from the wood of most coniferous trees; soluble in six parts of alcohol; decomposed with violence by bromine and iodine, and inflames when brought in contact with H_2SO_4 and HNO_3 .

VOLATILE OR ESSENTIAL OILS.

Give a brief account of this class of substances.

Volatile oils exist in aromatic plants, from which they may be separated by distillation in the presence of water, or by passing steam through the bruised substance. The steam, in its passage through the material, carries with it the minute globules of oil over the neck of the retort, and finally into the receiver, where the oil is found floating on the condensed water; oils of lemon and orange are sometimes obtained by mere pressure of the rind of the fruit. Essential oils contain terpenes and a non-terpenoid substance, to which they sometimes owe their fragrance. (See also Stearoptens.)

How may the common adulterations of volatile oils be detected?

Fixed oil, by leaving a greasy stain on paper upon evaporation.

Alcohol, by decreasing in volume when shaken with glycerine or water (the glycerine or water increasing in proportion to the decrease in the bulk of volatile oil). A well-cultivated sense of smell is invaluable in guarding against adulteration with inferior oil.

Into what other classes, beside the terpenes, may the volatile oils be divided?

Oxygenated, *e.g.*, cinnamon; Sulphurated, *e.g.*, mustard; Nitrogenated, *e.g.*, oil of bitter almond.

What oils are derived by the action of a ferment?

Oleum Amygdalæ Amaræ and Oleum Sinapis Volatile.

What is enfleurage?

It is a name of a process by which delicate odors or volatile oils are extracted by the agency of fats; layers of flower-petals are placed upon trays covered with a layer of purified, inodorous fat. The absorptive property of the fat is thus taken advantage of by repeated macerations of fresh petals from time to time; the fat becomes the "*pommade*" of the perfumers. To extract from this pomade the odor of the flower-petal with which it has become impregnated, it is only necessary to macerate the fat with agitation in deodorized alcohol or cologne spirits; the solution thus prepared constitutes the *handkerchief extract* of commerce.

Mention the drugs yielding officinal volatile oils.*

Amygdala amara.

Anisum.

Aurantii Cortex.

Aurantii Flores.

Carum.

Cajuput.

Caryophyllus.

Chenopodium.

Cinnamomum.

Copaiba.

Cit. Bergamia

Coriander.

Cubeba.

Erigeron.

Eucalyptus.

Fœniculum.

Gaultheria.

Hedeoma.

Juniperus.

Lavendula { Tops and
Flowers.

Limonis Cortex.

Menthæ (Pip. and Vir.).

Myrcia.

Myristica.

Pimenta.

Rosa damascena.

Rosmarinus.

Ruta.

Sabina.

Santalum album.

Sassafras.

Sinapis nigra.

Terebinthinæ.

Thymus.

Valeriana.

* For other constituents, natural order, etc., see pages 122-130.

Are volatile oils a prominent constituent in other drugs than the above-named?.

There is a class of drugs in which volatile oil is associated with soft resin, another with certain bitter or acrid principles, etc.

Mention the drugs belonging to the above classes.*

Absinthium.	Inula.
Ammoniacum.	Lupulinum.
Anthemis.	Macis.
Artemisia.	Matico.
Arnica.	Matricaria.
Arnica root.	Magnolia.
Asafetida.	Marrubium.
Aspidium.	Melissa.
Aurantii Folia.	Mezereum.
Aurantii Fructus.	Menthæ (Pip. and Vir.).
Buchu.	Origanum.
Calamus.	Pilocarpus.
Calendula.	Piper.
Cannabis Americana.	Salvia.
Cannabis Indica.	Sambucus.
Cardamon.	Santonica.
Capsicum.	Scoparius.
Cascarilla.	Serpentaria.
Cypripedium.	Sinapis Alba.
Eupatorium.	Sinapis Nigra.
Galbanum.	Tabacum.
Grindelia.	Tanacetum.
Humulus.	Thuja.
Illicium.	Viburnum.

RESINS, OLEORESINS, GUM RESINS AND BALSAMS.

What are resins?

The natural resins obtained by exudation from plants seem to be oxidized products of terpenes and the allied hydro-

* For other constituents, natural order, etc., see pages 122-130.

carbons. They resemble stearoptens, but are not volatile; they differ from fats in being solid and brittle. They are insoluble in water and mostly soluble in alcohol. (The natural exuded resins must not be confounded with the resins and resinoids extracted from resinous drugs. See below.)

Name the natural resins of the U. S. P.

Gutta Perchæ, Resinæ (a residuum from distilled turpentine), Mastiche, Guaiaci resinæ (the latter is made by boiling the chips of guaiac wood in salt water, the resinous gum collected, melted and strained). The *pitches* (pix burgundica and pix canadensis) are resins containing but a small quantity of volatile oil, water, etc.

What is an oleoresin, and give officinal examples?

They are mixtures of resin and volatile oil, Terebinthina (gum turpentine), Terebinthinæ Canadensis (balsam of fir), Copaiba. These natural oleoresins should not be confounded with the officinal preparations known by this title.

What is a gum resin, and give examples?

They are mixtures of resin or oleoresin and gum; they form with water milky emulsions. Asafetida, Galbanum, Gamboge, Ammoniac and Myrrh.

What is a balsam, and give officinal examples?

A balsam is generally understood to be a resin or oleoresin containing benzoic or cinnamic acid; balsam Peru, balsam tolu and storax. (Canada balsam and copaiba are not balsams).

What drugs of the Pharmacopœia contain peculiar resins extracted by alcohol?

Cannabis Indicæ, Cimicifugæ, Gossypii Radix, Jalapa, Podophyllum, Rheum, Scammonium, Spigelia, Stillingia, etc.

What are the so-called (eclectic) resinoids?

Resin-like precipitates from concentrated alcoholic solutions

of the drug. The concentrated tincture is precipitated by a large quantity of water. This is collected, dried and powdered *e. g.*, Cimicifugin, Irisin, etc.

FIXED OIL, FATS AND SOAPS.

Give a brief sketch of the chemistry of fixed oils and fats.

They are apparently compounds—salts of fatty acids (oleic, stearic and palmitic) and an organic base (mainly glyceryl). Oils consist chiefly of *olein*, that is, of trioleate of glyceryl, $C_3H_5(C_{18}H_{33}O_2)_3$.

Hard fats mainly consist of *stearin*, that is, of tristearate of glyceryl, $C_3H_5(C_{18}H_{35}O_2)_3$. See also oleic acid.

Name the officinal fixed oils and fats.

Oleum Adipis, Amygdalæ Expressum, Gossypii Seminis Lini, Morrhuae, Olivæ, Ricini, Theobromæ, Tigllii, Adeps, Sevum.

What are waxes?

They are fats having a high fusing point. Wax, however, is a term more properly applied to the compounds of the fatty acids with radicals, such as *cetyl*, $C_{16}H_{33}$ (in spermaceti—ceteum), *ceryl*, $C_{27}H_{55}$ (in Chinese wax) and *myricil*, $C_{30}H_{61}$ (in beeswax). *Off.* *Cera alba* and *Cera flava*.

What are soaps?

Salts of oleic, stearic, palmitic acid, or a mixture of these three; those made with KHO are soft; those with NaHO are hard. Lead plaster is sometimes (not inappropriately) called lead soap.

Name the officinal soaps.

Sapo, prepared from soda and olive oil (Castile).

Sapo Viridis, prepared from potassa and fixed oils.

Off. Prep. Containing soap: Emp. Saponis; Linimentum Saponis; Tr. Saponis Viridis.

CARBOHYDRATES.

What are carbohydrates?

Substances composed of carbon, hydrogen and oxygen, the two latter being in the proportion to form water.

Mention the principal groups of the carbohydrates and their formulas.

Celluloses.	Saccharoses.	Glucoses.
$(C_6H_{10}O_5)_n$.	$C_{12}H_{22}O_{11}$.	$C_6H_{12}O_6$.
Cellulose.	Cane sugar.	Grape sugar (dextrose).
Starch.	Milk sugar.	Fruit sugar (lævulose).
Glycogen.	Maltose.	Galactose.
Dextrin.	Melitose.	Arabinose.
Gums.	Melezitose.	

What officinal substance represents the purest form of cellulose (cellulin)?

Gossypium (cotton). The officinal is ordinary cotton deprived of adhering impurities and fatty matter; it is known as *absorbent cotton*.

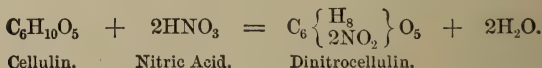
What effect have the strong acids upon it?

H_2SO_4 first swells, dissolves, and finally forms dextrin, which may be converted into glucose.

HNO_3 forms several compounds, prominent among which is gun-cotton, $C_6H_7O_5.(NO_2)_3$.

What is soluble gun-cotton, and how is it made?

Pyroxylinum; is made by acting upon cotton by means of H_2SO_4 and HNO_3 . The HNO_3 only is decomposed, represented by the following formula:—

**What are the physical properties of pyroxylin, and what important officinal preparations contain it?**

It is dissolved by alcohol and ether, when it forms the officinal collodions (*q. v.*).

What is the source, officinal name, and principal characteristics of starch?

Amylum, the fecula of wheat (*Triticum Vulgare*); insoluble in cold water; neutral to test-paper; under the microscope appearing as concentrically striated granules, more or less lenticular in form. When boiled with water, it yields a white jelly, having a bluish tinge, which, when cool, acquires a deep-blue color on the addition of test solution of iodine.

Mention some drugs containing amylaceous substances.

Althæa; Calumba; Chondrus; Cetraria; Jalap; Sarsaparilla; Ginger, etc.

What are the characteristics of gums?

They are insipid substances, soluble in water, forming a mucilaginous liquid or a jelly-like adhesive mass.

What two gums are officinal, and what are their properties?

Acacia, comes in roundish, brittle tiers of various sizes, or broken, angular fragments, soluble in water, forming a thick, mucilaginous liquid.

Tragacanth, comes in thin bands, more or less curved, not transparent, swelling in water, forming a gelatinous mass.

What are the chemical composition and properties of acacia and tragacanth?

Acacia is a salt of Arabic acid and lime, magnesium and potassium.

Tragacanth contains tragacanthin and a salt of gummic acid and calcium, not identical with that of gum arabic. Mucilage of acacia yields a gelatinous ppt. with subacetate of lead, ferric chloride, and concentrated solution of borax, and is not colored by iodine. Tragacanth mucilage is tinged blue by iodine, the fluid portion is not disturbed by ferric chloride or borax.

What is dextrin?

It is called British gum; its mucilage is very adhesive. It

is obtained by exposing starch to a dry heat of $175^{\circ}\text{C}.$; is a yellow amorphous powder.

What sugars are official?

Saccharum (saccharose), saccharum lactis (lactose). There are other officinal substances containing sugar, such as manna (containing mannit). Mel. (glucose, etc.).

What is glucose, and how is it made?

Grape sugar, or dextrose, is found in honey, raisins, etc. It is also a product of decomposition of glucosides. Made on a large scale by treating starch with sulphuric acid; precipitating the acid with CaCO_3 , decolorizing the liquid with animal charcoal and concentrating it in vacuum pans.

How may cane sugar, milk sugar, and glucose be distinguished?

Milk sugar is the least soluble crystalline sugar; it slowly reduces alkaline cupric solutions.

Glucose is very soluble; rapidly reduces metallic oxides; minute traces of glucose reducing cupric solutions.

Cane sugar, very sweet taste; does not reduce cupric solutions.

Glucose is less soluble in water and more soluble in alcohol than cane sugar.

Glucose rotates the plane of polarization strongly to the right.

Cane sugar furnishes a thick syrup, which, on the other hand, is levogyrate.

What is the specific angle of rotation of glucose?

+ 56 , and the formula for computation is $\frac{100 \times \text{angle}}{56}$; thus, if 2.8° were the observed angle, the formula would read

$$\frac{100 \times 2.8}{56} = \frac{280}{56} = 5 \text{ per cent.}$$

GLUCOSIDES.

What are glucosides?

Organic neutral compounds existing in plants, which, when acted upon by ferments or acids, are split up into glucose and other bodies; the officinal glucosides are six in number, and, like neutral principles, their names terminate in *in* (Latin, *inum*).

Name the officinal glucosides.

Chrysarobinum, Elaterinum, Glycyrrhizinum (ammoniated), Picrotoxinum, Salicinum, Santoninum.

How may a glucoside be extracted from a drug?

This may be shown by a synopsis of the process for the extraction and separation of *santonin*:—

Santonica is mixed with lime and extracted by dilute alcohol; the alcohol is distilled off and acetic acid is added to the residue when the santonin precipitates. The crude santonin is dissolved in alcohol, and purified by treating the alcoholic solution with charcoal and crystallizing. Processes of extraction vary, however, according to the nature of the drug in which the glucoside resides.

How is ammoniated glycyrrhizin made?

The powdered licorice root is extracted with ammoniacal water; the alkaline solution is then precipitated by H_2SO_4 ; the ppt. washed and redissolved, by the aid of water of ammonia; again precipitated by H_2SO_4 ; ppt. collected and washed, and redissolved in diluted water of ammonia; finally, the clear solution is spread upon plates of glass to dry (scale).

Mention some drugs containing other interesting glucosides.

Absinthium (absinthin).

Arnica (arnicin).

Aloe (aloin).

Asclepias (asclepidin).

Althæa (asparagin).

Bryonia (bryonin).

Amygdala amara (amygdalin).

Calamus (acorin).

Cantharis (cantharidin).	Quassia (quassiin).
Chimaphila (arbutin).	Quercus (quercitrin).
Colocynthis (colocynthin).	Quillaia (saponin).
Digitalis (digitoxin).	Sarsaparilla (sarsaparillin).
Euonymus (euonymin).	Scilla (scillitoxin scillipierin, etc.).
Elaterium (eleterin).	Simaruba (quassin).
Frangula (frangulin).	Taraxacum (taraxacin).
Gaultheria (arbutin, ursone).	Uva Ursi (arbutin, ursone, erico-
Mezereon (daphnin).	lin).
Myrcia (myricin).	Vanilla (vanillin).
Podophyllum (podophyllotoxin, etc.).	Viburnum (viburnin).

ACRID PRINCIPLES.

What is meant by the term acrid principle?

Acrid principles are extractive substances, frequently amorphous, of various composition; they are usually neutral principles, sometimes resinous, whose names end in *in*; some, however, have acid character, as senegin (polygallic acid); many of them resemble the glucoside saponin, as found in quillaia, etc.

Mention some acrid drugs.

Aconitum.	Caulophyllum.	Methysticum.	Sarsaparilla.
Allium.	Chelidonium.	Piper.	Scammonium.
Armoracia.	Colchicum.	Podophyllum.	Scilla.
Arnica.	Dracontium.	Pyrethrum.	Senega.
Arum.	Elaterium.	Quillaia.	Sinapis.
Bryonia.	Helleborus.	Rhus Toxicodendron.	Stillingia.
Cambogia.	Iris.	Sabadilla.	Tabacum.
Cantharis.	Leptandra.	Sanguinaria.	Tiglii Semen.
Capsicum.	Lobelia.	Saponaria.	Veratrum Viride.

ALKALOIDS.

Mention the characteristics of the alkaloids.

They are active vegetable principles, behaving toward acids as does ammonia, which fact gives them the Greek termina-

tion (oid) = alkali-like bodies; most of them contain nitrogen; they form precipitates with tannic acid, forming insoluble tannates (for this reason tannin is used as an antidote for them); they are precipitated also by the fixed alkalies, also by phospho-tungstic acid, ammonium molybdate, potassium iodo-hydrargyrate, platinic chloride, picric acid, etc.

Name the officinal alkaloids.

The following is a list of the officinal alkaloids, some of which are officinal salts, as indicated:—

OPIUM ALKALOIDS.

Opium, contains 9 per cent. *morphine*.

Opium Denarcotisatum, contains 12–16 per cent. *morphine*.

Morphina, $C_{17}H_{19}NO_3H_2O$.

Morphinæ Hydrochloras, Hydrochlorate of Morphine, $C_{17}H_{19}NO_3HCl.3H_2O$.

Morphinæ Sulphas, Sulphate of Morphine, $C_{17}H_{19}NO_3H_2SO_4.5H_2O$.

Morphinæ Acetas, Acetate of Morphine, $C_{17}H_{19}NO_3.HC_2H_3O_2.3H_2O$.

Codeina, *Methyl Morphine*, $C_{18}H_{21}NO_3H_2O$.

Apomorphinæ Hydrochloras, Hydrochlorate of Apomorphine, $C_{11}H_{17}NO_2.HCl$. An artificial alkaloid formed by heating morphine in a sealed tube with strong hydrochloric acid.

CINCHONA ALKALOIDS.

Cinchona Flava contains 2 per cent. *quinine*.

Cinchona Rubra contains 2 per cent. *quinine*.

Quinina, Quinine, $C_{20}H_{24}N_2O_2$.

Quininæ Bisulphas, Bisulphate of Quinine, $C_{20}H_{24}N_2O_2H_2SO_4.7H_2O$.

Quininæ Hydrobromas, Hydrobromate of Quinine, $C_{20}H_{24}N_2O_2HBr.2H_2O$.

Quininæ Hydrochloras, Hydrochlorate of Quinine, $C_{20}H_{24}N_2O_2 \cdot HCl \cdot 2H_2O$.

Quininæ Sulphas, Sulphate of Quinine, $(C_{20}H_{24}N_2O_2)_2H_2SO_4 \cdot 7H_2O$.

Quininæ Valerianas, Valerianate of Quinine, $C_{20}H_{24}N_2O_2 \cdot C_{18}H_{10}O_2 \cdot H_2O$.

Quinidinæ Sulphas, Sulphate of Quinidine, $(C_{20}H_{24}N_2O_2)_2H_2SO_4 \cdot 2H_2O$.

Cinchoninæ, *Cinchonine*, $C_{20}H_{24}N_2O$.

Cinchoninæ Sulphas, Sulphate of Cinchonine, $(C_{20}H_{24}N_2O)_2H_2SO_4 \cdot 2H_2O$.

Cinchonidinæ Sulphas, Sulphate of Cinchonidine, $C_{20}H_{24}N_2O \cdot H_2SO_4 \cdot 3H_2O$.

Chinoidin, Mixture of alkaloids.

STRYCHNINE.

Nux Vomica contains 0.2–0.5 per cent. *strychnine*.

Ignatia contains 1.0–1.5 per cent. *strychnine*.

Strychnina, Strychnine, $C_{21}H_{22}N_2O_2$.

Strychninæ Sulphas, Sulphate of Strychnine, $(C_{21}H_{22}N_2O_2)_2H_2SO_4 \cdot 7H_2O$.

ACONITINE. (Unofficial.)

Aconitum.

ATROPINE.

Belladonnæ Folia.

Belladonnæ Radix.

Atropina, Atropine, $C_{17}H_{23}NO_3$.

Atropinæ Sulphas, Sulphate of Atropine, $(C_{17}H_{23}NO_3)_2H_2SO_4$.

CAFFEINE.

Caffeina, $C_8H_{10}N_4O_2 \cdot H_2O$.

COCAINE, $C_{16}H_{19}NO_4$. (Unofficial.)

Erythroxyton.

CONIINE, $C_8H_{17}N$. (Unofficial.)

Conium.

HYOSCYAMINE, $C_{17}H_{23}NO_3$.

Hyoscyamus.

Hyoscyaminæ Sulphas ($C_{17}H_{23}NO_3$) $_2H_2SO_4$.

NICOTINE. (Unofficial.)

Tabacum.

PILOCARPINE, $C_{11}H_{16}N_2O_2$.

Pilocarpus.

Pilocarpinæ Hydrochloras, Hydrochlorate of Pilocarpine,
 $C_{11}H_{16}N_2O_2HCl$.

PIPERINE.

Piper Nigrum.

Cubeba.

Piperina, $C_{17}H_{19}NO_3$, Piperine.

VERATRINE.

Sabadilla.

Veratrina, Veratrine, $C_{32}H_{50}NO_9$.

PHYSOSTIGMINE, $C_{15}H_{21}N_3O_2$.

Physostigma.

Physostigminæ (Eserine) *Salicylas*, Salicylate of Physostigmine, $C_{15}H_{21}N_3O_2.C_7H_6O_3$.

Mention some drugs containing other alkaloids.

Colchicum (colchicine).

Ipecac (emetine).

Erythroylon (cocaine).

Sabadilla (veratrine).

Granati (pelletierine).

Stramonia (daturine).

Guarana (caffeine).

Tabacum (nicotine).

Hydrastis (berberine, hydrastine). Veratrum viride (jervine).

Antifebrin (acetanilid) and many like artificial products are erroneously supposed by some to be *alkaloid* in character.

They are, however, *neutral* chemical products. *Antifebrin* is obtained by the action of glacial acetic acid and heat on aniline.

FERMENTS AND THEIR PRODUCTS.

Give a brief account of this class of bodies.

There are two classes of ferments, known respectively as *organized* and *soluble* ferments. The former are minute bodies of organic structure capable of growth and reproduction, illustrated by the so-called brewer's yeast (*torula*, or *saccharomyces cerevisiae*). The *soluble* ferments, on the other hand, have no organic structure and do not grow and reproduce as animalcula. These fermentative principles are formed in certain fluids of the body, etc.—*Ptyalin* (in the saliva), *Pepsin* (in the gastric juice), *Pancreatin* (in the pancreatic juice), *Diastase* (in malt), *Emulsin* (in almonds), *Myrosin* (in mustard), etc.

What are some of the special properties of these unorganized ferments?

Ptyalin converts starch into sugar.

Diastase converts starch into sugar.

Pepsin converts albumen into peptone in acid solutions.
(See pepsin test in U. S. P.)

Pancreatin converts albumen and caseine into peptone in alkaline solutions, emulsifies fats, and converts starch into sugar.

Emulsin and *myrosin* (see below, under cyanogen).

How is pepsin made?

Pepsina Saccharatum, U. S. P., is made by digesting the inner mucous lining of the stomach of the hog with acidulated (HCl) water; straining the solution and precipitating it by NaCl; the light flocculent precipitate which rises and floats on the surface is collected, washed, dried, pulverized and

diluted with sugar of milk, so that it will be of such strength that 1 gr. will dissolve 50 grs. of coagulated albumen.

Mention some of the products resulting from the action of ferments (including the organized ferments).

All of the crude alcohols, such as wine, whiskey, brandy, acetic acid, etc., the by-products, cream of tartar and tartaric acid (from organized ferments).

Oil of bitter almonds and oil of mustard are the result of unorganized fermentative action.

In making citric acid, fermentation is employed.

NOTE.—For further details, see substances named.

CYANOGEN COMPOUNDS.

What is the composition and properties of cyanogen?

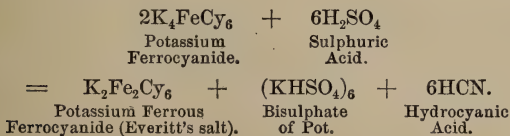
Cyanogen (CN) as met with in compounds is a univalent radical, and behaves chemically like the halogens. The gas (CN)₂ is very irritating to the eyes and air passages, and possesses a penetrating odor like bitter almonds.

What compound is formed with Cy and H?

Hydrocyanic, or Prussic Acid, HCN or HCy.

Name two methods of manufacture of this acid and its strength.

It is made first by decomposing ferrocyanide of potassium with H₂SO₄, thus:



Second by decomposing AgCy by means of HCl. Strength two per cent. of absol acid.

What other substances contain HCN?

Bitter almonds, wild cherry bark, and the kernels of the peach and plum, etc.

Does HCN pre-exist in bitter almonds and wild cherry, etc.?

No; it is formed by the action of two substances, known as amygdalin and emulsin (the former does not exist in sweet almonds); this action takes place when these substances are brought in contact with water, and is found associated with the volatile oil (*oleum amygdalæ amaræ*.) (See also Ferments.)

What cyanogen compounds are found in oil of mustard?

Crude oil of mustard often contains *cyanide of allyl*, C_3H_5-CN .

The oil of white mustard is known as sulphocyanate of acrinyl (C_7H_7OCNS), and the oil of black mustard the sulphocyanate of allyl (C_3H_5CNS).

Explain the formation of this oil.

The white mustard seed contains *sinalbin*, a glucoside which, in contact with *myrosin*, a ferment, produces the oil of white mustard.

The black mustard contains *sinigrin* and *myrosin*, which, like the former, under the influence of moisture and consequent fermentation produces the pungent volatile oil.

Animal Drugs.

Name the officinal animal drugs and their products which have not been previously mentioned.

Cantharis, Coccus, Fel Bovis (inspissated and purified ox-gall), Moschus, Sevum, Vitellus.

Name some of the active constituents found in the above drugs.

Cantharis (cantharidin), Coccus (red coloring matter, wax

and fat), Moschus (ammonia, cholesterin, fat), Sevum (stearin and palmitin), Vitellus (albumen vitellin).

Coloring Matter.

Mention some drugs containing coloring matter and coloring principles.

Alkanna.	Curcuma.	Madder.	<i>Chlorophyl.</i>
Arnotta.	Draco.	Rheum.	<i>Erythrophyl.</i>
Calendula.	Gamboge.	Rhoeas.	<i>Xanthophyl.</i>
Carthamus.	Hæmatoxylon.	Rosa Gallica.	Sap Green.
Catechu.	Kino.	Sanguinaria.	Indigo.
Cochineal.	Krameria.	Santalum ru-	Orseille.
Crocus.	Litmus.	brum.	

Alkanin, soluble in ether, alcohol, fats and certain volatile oils, alkalis change to blue; for coloring tinctures or pomade.

Rubia (Madder) contains *Ruberythrin* (yellow needles, blood-red with alkalis), *Alizarin* (orange-red needles, purple or blue with alkalis), *Purpurin* (red needles, violet-colored with alkalis).

Crocin, insoluble in ether, soluble in alcohol, colored blue by H_2SO_4 .

Curcumin, orange-yellow, insoluble in water, soluble in alcohol and ether, red-brown with alkalis and boric acid.

Cambogic acid (soluble in alcohol and ether, colored black-brown by ferric chloride; soluble in alkalis with a red color).

Hæmatoxylin, colorless, sweet, soluble in water and alcohol, red in sunlight purplish by alkalis.

Hæmatin (a product of the above), green metallic lustre, soluble in alkalis with blue color.

Litmus, blue; red with acids.

Quercitrin (in rosa gallica and quercus tinctoria), yellow crystalline, nearly insoluble in cold water, colored dark green

by ferric salts (an infusion of *rosa gallica* by dilute acid is colored red).

Sanguinarine, white, soluble in alcohol, ether and benzol, yields bright red salts.

Santalic Acid, red needles, soluble in ether with a yellow, and in alkalis with violet color; *pterocarpin* and *santal*, colorless, insoluble in water; the solution of the latter in alkalis turns red and green.

DISPENSING—INCOMPATIBILITY.

DEFINED.—That condition in which there exists either “*a chemical change*” or decomposition, a *therapeutical* opposition of constituents, or a *mechanical* dissociation of constituents (the latter may be termed *pharmaceutical* incompatibility).

CHEMICAL INCOMPATIBILITY.—Where chemical change results.

THERAPEUTICAL INCOMPATIBILITY.—Where there is antagonism in physiological action.

PHARMACEUTICAL INCOMPATIBILITY.—Where there is dissociation of constituents, resulting, it may be, from quality of ingredients or from violation of correct pharmaceutical procedure.

REMARKS.—*A prescription may be chemically or pharmaceutically incompatible and be compatible therapeutically*, because it furnishes just what the physician demands. (Ex., $\text{ZnSO}_4 + \text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 + \text{Aq.}$ —Injection.)

A PRESCRIPTION IS ABSOLUTELY INCOMPATIBLE when the chemical or pharmaceutical incompatibility sustained defeats the object of the physician, producing new products having totally different therapeutic effects than those obviously intended.

The intended therapeutic action is therefore the basis of final decision as to whether the pharmacist shall or shall not decline or hesitate to compound a prescription.

Incompatibility, embraced as it is within the foregoing propositions, seems quite comprehensible; but we must remember that there are a vast variety of combinations possible in prescription compounding, and while incompatibility is not a formidable subject, it becomes complicated when we consider that almost every new prescription is largely a law unto itself until tried. Therefore, expertness in pharmaceutical manipulation, of which prescription work is the highest type, becomes a matter of *individual ability*, and can only be acquired in the largest and best measure by *personal experience*. To be expert, however—to be able to detect any deviation from the right standard and solve the multifarious puzzling problems—requires, *first*, the knowledge and realization of the truths of the fundamental principles laid down, and a clear understanding of the *chemical and pharmaceutical properties* of medicinal substances.

ARRANGEMENT OF INCOMPATIBLE SUBSTANCES.

In using the following table, it is only needful to remember the well-known chemical law that if a solution of a compound be brought in contact with a solution of another compound, and by an interchange of radicals an insoluble compound be produced, that compound is precipitated.

Acetates are soluble.

Arseniates are insoluble, except those of the alkali metals.

Arsenites are insoluble, except those of the alkali metals.

Bromides are soluble, except mercurous and silver; those of *antimony and bismuth are decomposed by water to form oxysalts*.

Carbonates are insoluble, except those of the alkali metals.

Chlorides are soluble, except those of lead (*s*),* mercurous and silver.

* Sparingly soluble (*s*).

Citrates are soluble, except those of magnesia, mercurous, silver and strontium, aluminium (s), barium (s), bismuth (s), cadmium (s), calcium (s), lead (s), zinc (s).

Cyanides are insoluble, except the mercuric and those of the alkaline metals and earths.

Hydrates are insoluble, except those of barium, strontium, calcium (s) and lead (s) and the alkali metals.

Iodides are soluble, except those of antimony, bismuth, gold, lead (s), mercuric, mercurous, platinum (s) and silver.

Nitrates are soluble.

Oxalates are insoluble, except those of antimony (s), chromium, ferrous (s), stannic, and the alkali metals.

Oxides are insoluble, except those of barium, strontium, calcium (s), and the alkaline metals.

Phosphates (ortho) are insoluble, except those of the alkali metals.

Sulphates are soluble, except those of barium, strontium, calcium (s), antimony, lead, mercurous (s) and silver (s).

Sulphides are insoluble, except those of barium, calcium (s), strontium and the alkali metals.

Sulphites are soluble, except those of aluminium, antimony, barium, bismuth, calcium (s), cobalt (s), copper, ferrous (s), lead, manganese (s), nickel (s), silver, stannous, strontium and zinc (s).

Tartrates are soluble, except those of antimony, barium, bismuth, cadmium (s), calcium (s), copper (s), ferrous (s), lead, manganese (s), mercuric, mercurous, nickel (s), silver, strontium (s), and zinc (s).

ACIDS decompose hydrates, carbonates and acid carbonates to form salts.

STRONGER ACIDS (largely inorganic) set free the weaker acids (largely organic), or, brought in contact with alcohol or alcoholic solutions, form ethers.

Alkaline hydrates, carbonates and acid carbonates neutralize

free acids, decompose some glucosides, and precipitate all alkaloids, some of which precipitates are soluble in excess of the precipitant, or in alcohol, if that liquid be present in sufficient amount to dissolve them.

OXIDIZING AGENTS, such as *nitric, hydrochloric, nitrohydrochloric, picric and chromic acids, and potassium bichromate and permanganate, with readily oxidizable substances, such as carbohydrates, alcohols, ethers, sulphur, phosphorus, sulphides, and organic matter in general*, form explosive compounds.

Potassium permanganate, if ordered in pill form, can best be made with cacao butter and cosmoline in very small quantity, and enclosed in gelatin capsules.

Silver nitrate is reduced by organic matter to oxide, with the exception, it is said, of opium and extract of hyoscyamus. A very good way of making pills of it is with cacao butter and cosmoline, etc., as mentioned above, under potassium permanganate.

Syrup of ferrous iodide and potassium chlorate form a poisonous compound.

Potassium iodide and potassium chlorate form a mixture which yields the poisonous iodate on being taken internally.

Iodine and the iodides yield precipitates with the alkaloids.

Bromides precipitate morphine and strychnine salts on standing, but a few drops of dilute hydrochloric acid added, after the addition of the alkaloid, prevents the change.

Sodium biborate precipitates morphine and cocaine salts, but on the addition of a small quantity of boric acid, or with boric acid, precipitation does not take place.

Mercuric chloride with acidulated solutions of alkaloids forms crystalline double salts.

Potassium-mercuric iodide precipitates alkaloidal solutions.

Solutions of quinine salts with those of the alkaline acetates, or with Basham's mixture, precipitate the sparingly soluble qui-

nine acetate. *Morphine solutions*, give the phenol reaction, if mixed with tincture of ferric chloride.

GLUCOSIDES are decomposed by free acids and precipitated by tannin; *tannic and gallic acids* precipitate alkaloids, albumen, gelatin and the majority of metallic salts, and yield inks with iron solutions.

Resinous tinctures and fluid extracts, prescribed with aqueous solutions, should always be emulsified with acacia; *tinctures and fluid extracts made of stronger alcohol, mixed with those made of diluted alcohol*, become turbid and precipitate, since the special solvent power of alcohol, or of water, for a substance diminishes in proportion to the quantity of the other liquid present. A "shake" label should always be used.

Fixed and volatile oils and oleo-resins, and aqueous solutions, when for internal use, should always be emulsified, whether ordered or not, and, to better emulsify the volatile oils, they should have mixed with them, prior to emulsification, an equal volume of olive, almond, or cotton-seed oil.

Tincture of ferric chloride gelatinizes mucilage of acacia.

Free acids separate insoluble carminic acids from compound tincture of cardamon; *free acids precipitate glycyrrhizin* from fluid extract of licorice.

Commercial spirits of nitrous ether liberates iodine from solutions of iodides, *decomposes antipyrine solutions*, to form a green nitro-derivative, and precipitates mucilage of acacia, but if it be well diluted with water it can usually be added last without precipitating.

Tincture of guaiac and spirits of nitrous ether are stated to be pharmaceutically incompatible by Potter (although they are often prescribed together), likewise infusion of wild cherry with compound infusions of gentian, and infusions with metallic salts generally.

Sodium salicylate in solution precipitates the sparingly solu-

ble salicylic acid if mixed with acids, and yields, if dispensed in powders with potassium acetate, the very deliquescent potassium salicylate. *Sodium salicylate in strong solution* is decomposed by tincture of ferric chloride, but if well diluted first changes only into ferric salicylate. *Sodium benzoate* solution is decomposed by acids to yield the sparingly soluble benzoic acid.

Mercuric chloride is decomposed by solution of potassium arsenite, but if the alkaline solution has first added to it, in slight excess, diluted hydrochloric acid, no precipitation will take place on the addition of the mercurial salt.

Pyrophosphate and phosphate of iron solutions precipitate with phosphoric acid.

The national formulary recommends the use of dilute metaphosphoric acid, in place of the officinal "ortho" variety, as yielding a permanently clear solution.

ANTAGONISTS.

(THERAPEUTIC INCOMPATIBLES, ETC.)

Antagonists are agents which directly oppose each other in some or all of their physiological actions, and, therefore, may be used one against the other, in a case of poisoning by either, to counteract its effect upon the organism after it has been absorbed, and when, therefore, the time for an antidote has passed. Antagonistic action takes place in the blood and tissues, and is applicable almost entirely to vegetable poisons.

Antagonist of Phosphorus.—Sulphate of copper.

Antagonists of Cinchona Alkaloids.—Morphine is antagonistic to cinchona in its cerebral action; belladonna or atropine to its nervous, cardiac and antipyretic powers.

Antagonists of Ammonia.—Cardiac sedatives, aconite, digitalis, veratrum, etc. (HCl vapor, vegetable acids).

Antagonists of Strychnine.—Chloral, chloroform, chamomile

oil, physostigma, tobacco and potassium bromide. The latter is slow in its action.

Picrotoxin.—Chloral is antagonistic to its cerebral action, also spinal, but synergistic to its depressing power over the heart and respiration.

Digitalis.—Aconite is the best antagonist, also opium. Saponin and senegin are considered complete physiological antagonists.

Belladonna.—Opium is the physiological antagonist (?) for its effect on the cerebrum, pupil, heart, respiration, arterial tension, and kidneys. Physostigmine, aconite, pilocarpine and quinine are each antagonistic to some of its effects; muscarine to most of them.

Coca.—Amyl nitrite is the antagonist in cardiac depression, then alcohol and opium as stimulants to the heart. Chloral is the most direct antagonist, also chloroform and ether. Morphine is also directly antagonistic at almost all points.

Chloral.—Atropine antagonizes its cardiac, respiratory and spinal depression. Morphine given with chloral prevents the tendency to cardiac failure, while synergistic to its hypnotism.

Opium.—Atropine antagonizes its cerebral action, also its action on the pupil, respiration, heart and arterial tension. Strychnine, coffee, caffeine and cocaine are also physiologically antagonistic to morphine.

Bromides.—Digitalis, ergot and belladonna antagonize many of the effects of the bromides, but morphine is the most efficient antagonist, especially for the mental symptoms.

Conium.—Nux vomica and its alkaloids; also picrotoxin and other tetanizers are physiological antagonists.

Gelsemium.—Opium is the antagonist.

Curare.—Strychnine, though from the same family, is antagonistic as to the effects on the heart and respiration.

Pilocarpus.—Atropine; its antagonism is very complete throughout the whole range of action. Conversely, *Pilocar-*

pine is exactly antagonistic to atropine, but jaborine acts similar to the latter drug.

Muscarine.—Atropine exactly opposes muscarine, and *vice versâ*.

Physostigma.—Atropine as to the respiration, heart and pupil. Chloral is also antagonistic.

Aconite.—Atropine, morphine and ammonia antagonize its effects on the heart and respiration. Digitalis counteracts its heart action and the relaxation of cardiac inhibition.

Veratrum.—Morphine and atropine antagonize the cardiac depression ; also alcohol, ammonia, etc.

Tobacco.—Strychnine is the true physiological antagonist of nicotine, and *vice versâ*. Alcohol, ammonia, ergot, digitalis, belladonna, etc., antagonize its action on the circulation.

Lobelia.—Strychnine, picrotoxine, and thebaine antagonize its action on the nervous system. The vasomotor excitants, as alcohol, digitalis, belladonna, oppose its effects on the circulation.

Hydrocyanic Acid.—Atropine is antagonistic (but, practically, is too slowly diffused to be of any value).

Barium.—Amyl nitrite, nitroglycerine, and similarly acting agents are its physiological antagonists.

Carbolic Acid.—Atropine is said to be a very complete physiological antagonist, maintaining the heart and respiration until elimination occurs, which should be promoted by diluents used freely.

Ipecac.—The emetic action is antagonized by the narcotics generally ; also by bismuth, carbolic and hydrocyanic acids.

EXPLANATIONS AND DIRECTIONS.

Figures following the name of the ingredients of preparations indicate the *percentage* of that ingredient in the preparation. See Official Preparations, pages 59–79.

Figures immediately preceding the name of a chemical substance indicate the solubility of that substance: 4, Lithii Benzoas, indicates that Benzoate of Lithia is soluble in 4 parts of water. See Inorganic Compounds, 79–115, etc.

It is recommended that the student use in his study, the table of “Official Drugs with Natural Order and their Constituents,” pages 122–130, in connection with the classification of official preparations found on pages 55–59. The figure placed immediately after the name of the drug (pages 122–130) indicates the number of preparations into which that drug enters. To find the *name* of that preparation it is only necessary to turn to pages 55–59, where it will be found under its proper head. Example:—On page 122 we find “Absinthium, Herba (1).” If now we turn to page 55 we will find *the name* of the official preparation into which absinthium enters (in the class of “drugs contained in one preparation only”) to be *Aromatic Wine*.

RESEARCH QUESTIONS. The questions are introduced at various points for the purpose of directing the student’s attention to the Pharmacopœia, where answers to them are to be obtained. The student himself may multiply these questions, and, following out the scheme suggested by these questions, may find it an invaluable drill.

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